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The Philippine Agricultural Review

VOL. XVIII

SECOND QUARTER, 1925

No. 2

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THE PHILIPPINE
Agricultural Review

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A PROGRESS REPORT OF THE CORN VARIETY TEST AT THE LAMAO EXPERIMENT STATION, LAMAO, BATAAN

By F. G. GALANG and P. L. PAULINO

INTRODUCTION

The corn work at this station was formerly confined to the propagation of corn for distribution, but in 1922 the corn project at La Carlota Experiment Station in Occidental Negros, was transferred to the Lamao Experiment Station, Lamao, Bataan. The project herein reported was undertaken to determine the comparative yields of eleven Philippine varieties of corn, as in all probability there are high yielding varieties among the Philippine corns which are particularly adapted in certain districts, and the only way to determine the value of these local varieties is to culture them together in different places having different soil and climate conditions, using one of the standard variety in the locality as a check crop.

A varietal test of 32 varieties of corn was conducted by Emilio K. Morada at the College of Agriculture, Los Baños, in Laguna, but the materials used were mostly of foreign varieties and similar work was performed by Francisco D. Marquez, using six Philippine varieties of corn, at the La Carlota Experiment Station, La Carlota, Occidental Negros.

Morada reports that the following yields were obtained under Los Baños conditions:

Variety name	Rainy season		Dry season	
	Computed yield of ears per plant	Computed yield of shelled corn per plant	Computed yield of ears per plant	Computed yield of shelled corn per plant
Calamba Yellow Flint	Grams 92.79	Grams 79.24	Grams 97.30	Grams 80.17
Cebu White Flint	50.11	42.73	88.89	74.77
Moro White Flint	26.52	21.13	104.18	79.70

A distance of 1×0.75 meter apart was used in this culture, and two stalks were allowed to develop in each hill so that in a hectare of ground there would be 26,666 corn plants. Computing the above results to the hectare the following yields were

obtained from a 100 per cent stand: The Calamba Yellow Flint yielded 2,113 kilograms (36.1 cavans) of shelled corn during the rainy season and 2,137.81 kilograms (36.5 cavans) during the dry season. The Cebu White Flint 1,139.44 kilograms (19.4 cavans) of shelled corn during the rainy season and 1,993.82 kilograms (34.08 cavans) during the dry season. The Moro White Flint yielded 563.45 kilograms (9.6 cavans) of shelled corn during the rainy season and 2,125.28 kilograms (36.3 cavans) during the dry.

Marquez reports that the following yields were obtained under La Carlota conditions:

Variety name	Average yield per hectare in cavan		
	Actual	Corrected at 100 per cent stand	Corrected based on check
Bohol White Flint.....	23.87	30.53	15.41
Cebu White Flint.....	26.42	32.49	28.22
Moro White Flint.....	27.13	34.98	26.65
Baluga Yellow Flint.....	31.38	41.65	27.51
Cagayan Yellow Flint.....	25.07	34.84	26.40
Calamba Yellow Flint.....	27.78	35.29	26.47

These projects, though, were carried out under different conditions are valuable only in so far as they give some indication of the comparative yields of the varieties tested.

MATERIALS AND METHOD

There are many strains of corn under cultivation in the Islands, but the present experiment being conducted at the Lamao Experiment Station deals only with nine supposedly Philippine and two foreign varieties; namely, Moro White Flint, Cagayan Yellow Flint, Kalaylay White Flint, Lobo Yellow Flint, Baluga Yellow Flint, Calipus White Flint, Calamba Yellow Flint, Bohol White Flint, Cebu White Flint, Ferguson White Dent, and Ferguson Yellow Dent. The seeds of all the native varieties except the Lobo, which was introduced from Lobo, Batangas, in 1922, were obtained from La Carlota Experiment Station. The Ferguson corns were received from the United States during the same year. The native corns under test are of the yellow and white flint type and the two Fergusons belong to the yellow and white dent type of corn.

CLIMATE

Table 1 gives the rainfall, the average relative humidity and the number of rainy days during the months when the variety tests were under culture in the field of the station.

The last two weeks of October and the first week of November in 1922, were dry and the planting of corn at this time was made possible only by irrigation. However, a normal amount of rain fell later which greatly favored the corn crop.

During May 1923, it was too wet and so the planting was delayed. October, on the other hand, was a dry month for planting the second crop of corn and to give it a good start irrigation water was used before planting. The test crop during this month was washed away by the flood of November 19, 1923, leaving only a portion of two out of the eleven varieties not destroyed. This was the second dry culture of the variety tests at Lamao, and no data on yield were obtained from them.

PLAN OF THE WORK

The land selected for the culture of the variety tests of corn was newly-opened *caĩngin* formerly full of brush wood, and planted to both rice and corn by the *caĩngin* system for one season. It is fairly level and well-drained land, capable of irrigation and cultivation. The soil is a porous clay loam underlaid with a brownish clay subsoil and almost uniform in soil fertility. But one main defect is the lack of sufficient humus for the best development of plants. It was plowed and harrowed two or three times previous to the planting of corn in each culture. Furrows were made from south to north. Three or four seeds were planted in each hill by hand and then covered with soil by a thrust of the right foot as the planter walked.

To minimize the errors as much as possible in this experiment rectangular plots were used which were uniformly prepared and given the same cultural treatment throughout the tests. Besides, check plots, screen, and guard rows were provided. The different varieties were planted side by side, alternating the yellow and white corns, but seeds for the succeeding plantings were obtained by planting a small lot of each variety in a separate culture every season to produce pure strains. The seeds used were practically of the same age. In calculating the results Mendiola's method was used as given in "Methods of Breeding Tropical Crops," pp. 34-35.

WET SEASON PLANTING

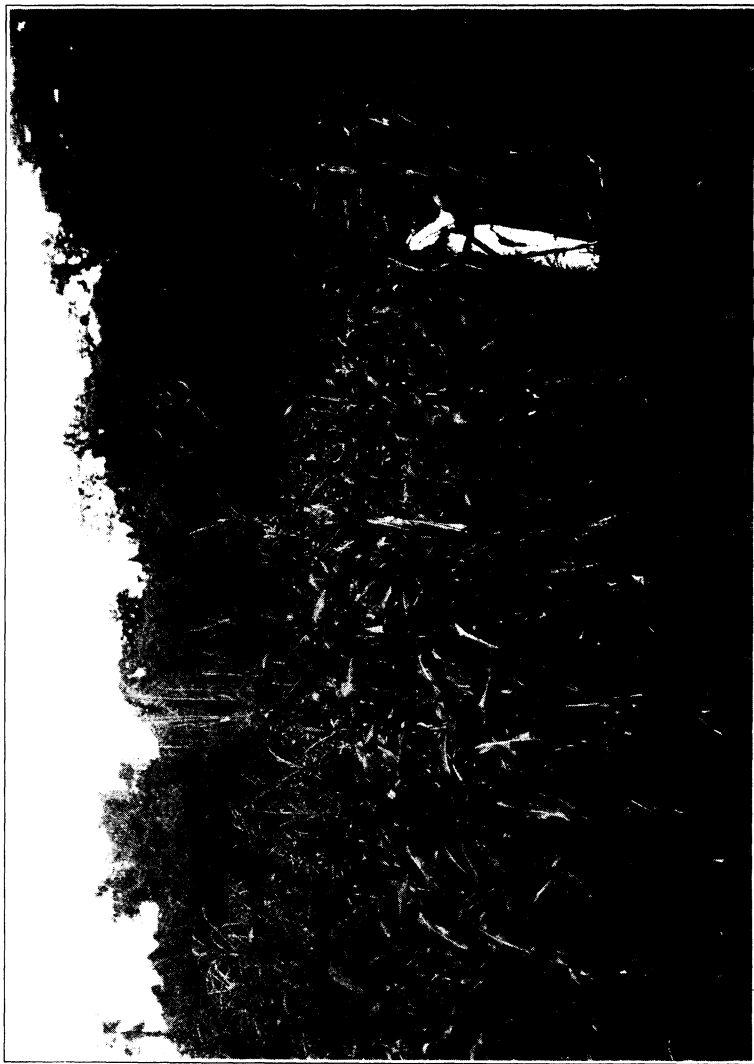
Six varieties of corn were planted May 22, 1922, as the first rainy season culture. The spacing was 1×0.75 meter and the area covered 2,520 square meters. This included the two check plots' one at each end of the field or a plot of 360 square meters for every variety. Germination took place within three days.

Tasseling began between July 1 and 15 and the silking stage 7 to 12 days later. The crops were harvested September 4, 1922.

For the second rainy season planting an area of 7,344 square meters was planted to eleven varieties, making 433 square meters to a plot, including the six check plots, which were planted to Moro corn. Sugar cane had been grown in an adjacent field for two years before it was used for corn. The land was plowed twice—April 25–28, and May 13, 1923; and harrowed April 26–29, and May 14–15, 1923. Furrowing was done at the time of planting the corn, which was May 24, 1923. Sixteen rows were planted in each of the plots, including the four screen rows at the ends of each plot separating the varieties from each other. The spacing was 1×0.85 meters. Germination took place May 27, 1923. Replanting was done a few days afterwards and in the course of time a good stand was obtained. Thinning was practised when the plants were about 20 days old, only two plants being left in a hill. Cultivation with a 5-tooth cultivator and a plow began June 17, 1923, and continued at regular intervals. The crops were harvested September 10–12, 1923. The ears were husked and well dried in the sun before the weighing of both shelled and unshelled corn was done.

DRY SEASON PLANTING

A plot of about 5,616 square meters was three times plowed and harrowed beginning October 9, 1922, and planted to nine varieties of corn. Each variety represented in the test occupied a plot 12×36 meters, or 432 square meters of ground. This area was divided into 16 rows including the four screen rows planted at the ends of the plot. Four check plots were used in this test planted with Moro corn. Furrowing and planting were done October 25–26, 1922, the spacing being 1×0.85 meter. Germination took place within three days. The Cagayan corn gave poor germination. These were the first seeds of this variety received from La Carlota Experiment Station. Replanting was done October 29–31, 1922, in order to insure a good stand. The culture was thinned when the plants were about 14 days old, leaving only two to the hill. The plantation was plowed three times in the native way, and irrigation by the furrows was twice necessary. Tasseling began December 12, 1922, and toward the end of the year the silkings appeared. The crops were harvested February 5–11, 1923, and were cut, husked and thoroughly dried before the shelled and unshelled corn was weighed.



A view of part of the Corn Variety Test Plot planted May 24, 1924

Tables 2, 3, and 4 give the yields of each variety, the number of days to maturity, and the shelling percentages.

RESULTS OF TESTS

It is almost impossible to overcome all difficulties in field culture, such as the attacks of pests and diseases, or of rodents, and to secure a perfect stand from all the varieties during the tests. However, the data given are as accurate as possible for these tests.

In Tables 2 and 3 are recorded the results of the two rainy-season plantings. The 1922 culture as given in Table 2 shows poor yields. Rats and wild hogs had eaten much of the corn. Besides the plants were damaged by two severe storms—one in May and one in July.

Of the six varieties tested the Bohol gave the highest yield and the Ferguson Yellow the lowest.

Considering the treatment given the 1923 rainy-season planting as shown in Table 3, poor results were also obtained. This was due to the fact that the first planting, which was done May 16, 1923, was destroyed by locusts, and a second planting had to be done rather late. The plants also suffered much from the continuous rains that fell from time to time up to the tasseling and silking stages of the corn. Besides the two typhoons of July and the strong winds of August greatly hindered their growth. The pollination was imperfect and some of the plants were blown down. As a result many did not produce good, well-filled ears.

The two Ferguson varieties were badly attacked by *Helminthosporium incuspicum*, which rendered the yields of these varieties poor.

The culture was also slightly attacked by rats and wild hogs, but this was allowed for in figuring the yields.

The yields obtained from the 1923 rainy-season planting as given in Table 3, were highest for the Calamba, Bohol, Kalaylay, and Lobo varieties both in ears and grains in the order of their enumeration—except the Lobo corn, which had more ears than the Kalaylay. The yields in grains were as follows: Calamba, 12.69 cavans of shelled corn per hectare; Bohol, 11.78 cavans; Kalaylay, 9.76 cavans; and Lobo, 9.37 cavans; or an increase of 7.18 per cent of the Calamba over the Bohol, 17.14 per cent of Bohol over the Kalaylay, and 3.99 per cent of Kalaylay over the Lobo variety. The percentage of increase of the Calamba

corn over the lowest yielding native variety in the test, which was in this case the Cebu corn, was 43.88 per cent per hectare.

Generally speaking the 1922-23 dry-season planting gave a good stand and with vigorous growing plants, bearing good-sized and well-filled ears—except the Cagayan and the Kalaylay, which gave rather low yields, partly because the plots where they were planted have rather a shallow soil. The two American varieties did not exceed the native corns in production, but they are promising varieties nevertheless.

Of the dry-season planting the best yielding varieties in the order of their yields of both shelled and unshelled corn in Table 4 are the Calamba, Calipus, Bohol, and Moro. The Calamba yielded as much as 53.85 cavans of grain per hectare; Calipus, 53.67 cavans; Bohol, 50.41 cavans; and the Moro, 42.94 cavans; or an increase of 0.33 per cent of the Calamba over the Calipus, 6.07 per cent of the Calipus over the Bohol, and 14.18 per cent of the Bohol over the Moro. The percentage of increase of the Calamba over the lowest yielding native variety in this test, which was Cagayan, was 37.15 per cent per hectare.

As it may be seen from the tables the size of ears played a very small part in the yields. The Bohol and Cebu had the smallest ears and yet Bohol stood first and second in yields during the rainy season and third during the dry-season culture, and while the Moro is one that produced large ears, it stood only fourth and seventh, respectively, in the test during the rainy-season cultures and fourth during the dry season.

The cobs of the two American varieties were rather small and had large grains compared with the native corns. However, they were not the highest throughout in the shelling percentage. The Ferguson White Dent was the highest during the dry-season culture, Cagayan second, Calamba and Ferguson Yellow third, and Moro corn the lowest among the varieties. During the rainy season the Calamba was the highest in shelling percentage, Bohol second, Kalaylay third, and Calipus the lowest of all. In the rainy season those varieties having the highest shelling percentages also gave the highest yields in the order of their shelling percentages except the Lobo corn, which was only sixth in the order of shelling percentages. During the dry season this is not the case, but instead Calamba which was first in yield was only third in shelling percentage, Calipus second in



Ferguson White Corn showing the effect of *Helminthosporium incuspicum*

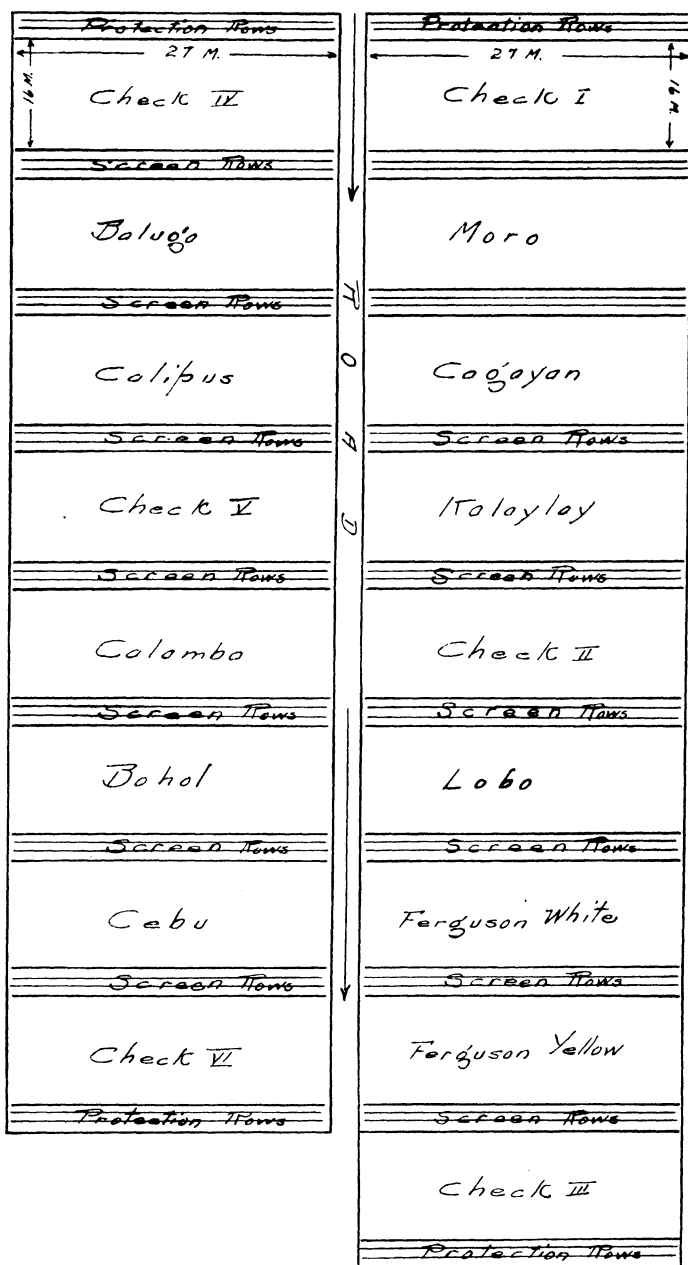


Fig. 5. Illustrating the Arrangement of the Experimental Plots

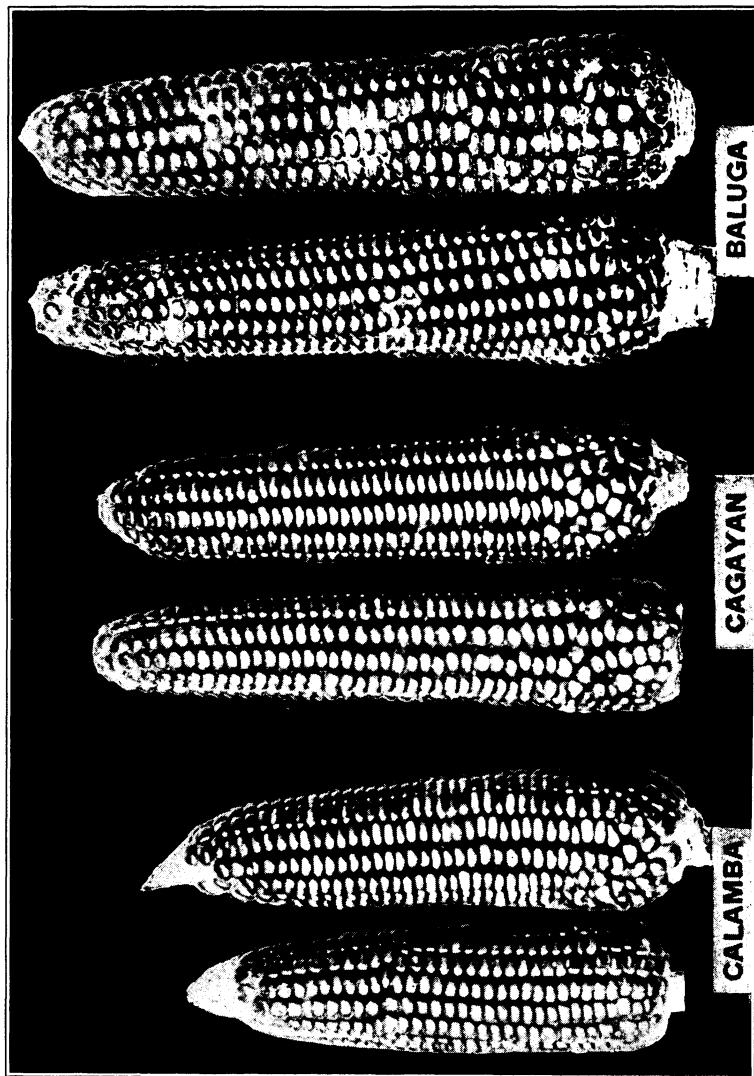
yield was only fourth, Bohol third in yield and only fifth in the shelling percentage, and Moro fourth in yield was the lowest in shelling percentage. Higher shelling percentages were obtained during the dry-season culture than during the rainy season for all the varieties.

The results also indicate that the corn usually has a longer growing period during the dry season than during the rainy season. This observation confirmed the results obtained by Marquez and Morada at La Carlota and Los Baños, respectively. In all the varieties tested in these three different places, including Lamao, the maturing period during the dry season was generally from two to twelve days longer than during the rainy season, depending upon the varieties.

Morada states that the best yielders during the rainy season were not always the highest producers during the dry season. His conclusions have been corroborated by Marquez and the results of this station. Morada reports also that the Calamba was the heaviest yielder among the native varieties during the rainy season and while Marquez, the Baluga corn was the first and Calamba was only second in yield. But Baluga corn was not included in Morada's culture. At Lamao the best rainy-season corn is the Calamba and the Bohol next. The Baluga corn ranks only fifth in the order of production.

It was also observed during the course of this experiment that very low yields were obtained from the rainy-season cultures of the different varieties of corn. This was due mainly to the washing away of the pollen by the rain and consequently imperfect fertilization of the plants. Small ears with very irregular kernels and with a free suckering habit of corn were, therefore, produced, although as a general rule the plants grow well at this season. Besides the numerous pests and diseases that usually appear this time of the year caused much damages. And really too, typhoons may blow the corn plants down.

The average yield of the eleven native varieties was 27.03 cavans per hectare, and if the average Philippine production had been equal to the variety test of this station instead of 6,883,996 cavans there would have been produced 14,699,670 cavans during the year 1921; or a difference of 7,815,674 cavans in favor of the station. And if a cavan of corn sells at ₱3 the sum of ₱23,447,002 would have been realized without there



Calamba, Cagayan, and Baluga Yellow Flint Corn

having been any increase in the area at present cultivated to corn in the Philippines. This amount would undoubtedly be increased further by planting the highest yielding variety, as from the results of the variety tests here the average production of the highest yielding variety is 33.27 cavans for the Calamba per hectare, 31.09 cavans for the Bohol, and 30.44 cavans for the Calipus.

CONCLUSIONS

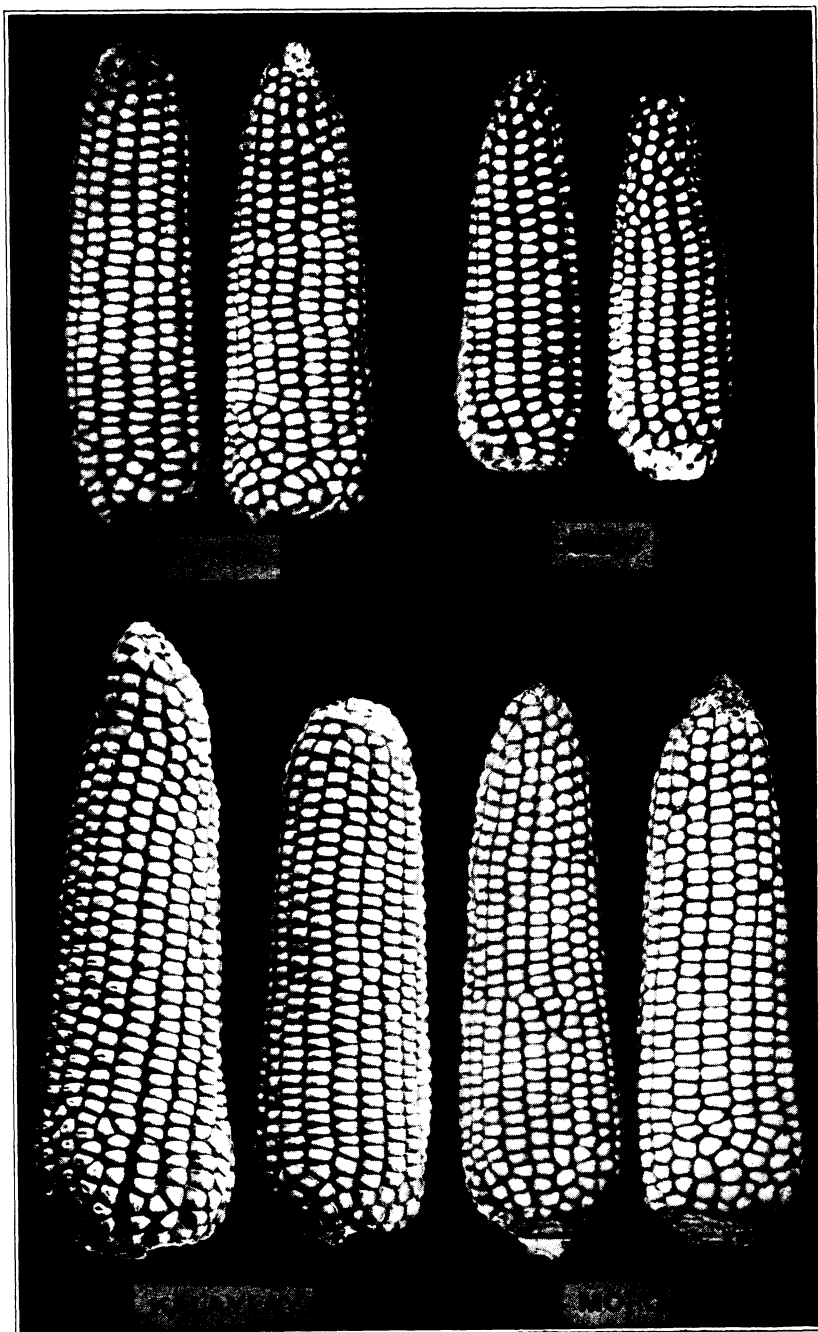
1. The highest yielders of corn during the rainy season were not always the best producers during the dry season.
2. The size of the corn ears does not effect the yields.
3. Ferguson White Dent was the highest in the shelling percentage during the dry season, and the Calamba during the rainy season.
4. Among the native corns the Calamba was the best in the shelling percentage.
5. The shelling percentages of corn played little part in the yields.
6. Higher shelling percentages were obtained during the dry season than during the rainy season for all the varieties.
7. Corn has a longer growing period during the dry season than during the rainy season.
8. Lower yields were obtained from the rainy-season than from the dry-season culture.
9. The Calamba, Bohol, Kalaylay, and the Lobo corns were the four producers during the rainy season.
10. The Calamba, Calipus, Bohol, and the Moro corns were the best producers during the dry season.
11. The Calamba and the Bohol were the best producers both during the rainy and dry seasons.
12. The present average production of corn in the Philippines could be doubled without increasing the area and expense of cultivation by planting adapted high-yielding varieties.

REFERENCES

1. Emilio K. Morada. Comparative Test of Thirty-two Varieties of Corn. *The Philippine Agriculturist*, Vol. 9, March-April, 1921, Nos. 8-9, pp. 209-17.
2. Francisco D. Marquez. Comparative Test of Six Philippine Corn Varieties conducted at La Carlota Experiment Station, La Carlota, Occidental Negros.

TABLE 1.—*Showing the average relative humidity, rainfall and the number of rainy days*

Month	Average real humidity			Rainfall in inches			Number of rainy days		
	Wet season 1922	Dry season 1922	Wet season 1923	Wet season 1922	Dry season 1922	Wet season 1923	Wet season 1922	Dry season 1922	Wet season 1923
May.....	82		80	10.42		20.62	9		13
June.....	85		89	9.36		21.15	16		21
July.....	89		76	35.12		14.91	24		17
August.....	84		86	8.62		54.30	8		25
September.....	88		87	18.91		17.68	17		19
October.....		83			7.98			9	
November.....		84			1.66			3	
December.....		84			5.37			8	
January.....		81			0.36			1	
February.....		80			2.50			2	
Total.....	428	412	418	82.37	17.87	128.66	74	23	95
Monthly average.....	85	82	83	2.78	0.59	42.88			



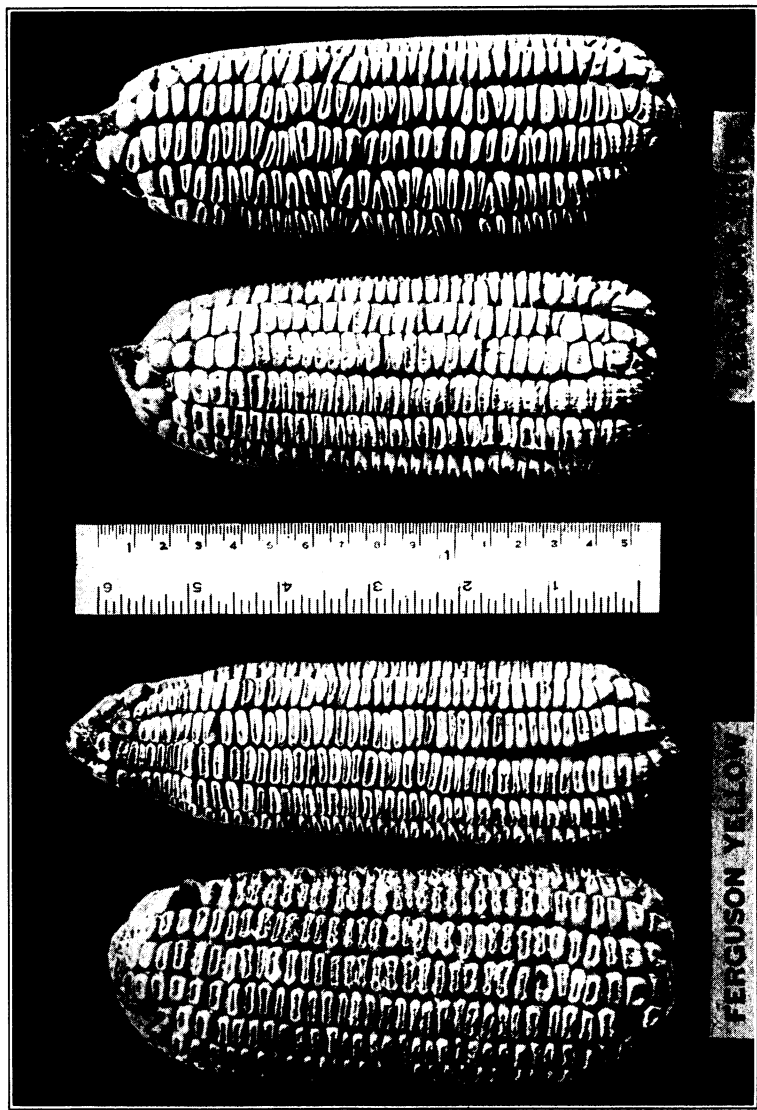
Bohol, Cebu, Kalaylay, and Moro White Flint Corn

TABLE 2.—*Rainy-season planting, 1922*

Variety name	Number of days of maturity	Per cent of stand	Yield of years in kilos						
			Actual	Computed yield at 100 per cent stand	Theoretical check yield of non-check plots	Difference between computed yield at 100 per cent stand and theoretical check yield of non-check plots	Average Theoretical yield of check plots	Theoretical yield of non-check plots	Computed per hectare
Check I (Cebu)	103	93	64.30	69.14	68.07	-14.45	65.42	50.99	1,416.38
Calamba	103	96	51.50	53.64	67.01	-41.46	65.42	23.96	665.55
Ferguson Yellow	103	87	22.23	25.55	65.95	-28.87	65.42	36.55	1,015.27
Ferguson White	103	89	33.00	37.08	64.89	+9.44	65.42	74.86	2,079.44
Bohol	103	97	72.10	74.33	63.83	-16.28	65.42	49.14	1,365.00
Moro	103	90	42.80	47.55	62.77	-1.00	65.42	64.42	1,789.44
Cebu	103	96	59.30	61.77					
Check II (Cebu)	103	96	59.30	61.71					

TABLE 3.—*Rainy-season planting, 1923*

Variety name	Number of days of maturity	Per cent of stand	Yield of ears in kilos						
			Actual	Computed at 100 per cent stand	Theoretical check yield of non-check plots	Difference between computed yield at 100 per cent stand and theoretical check yield of non-check plots	Average theoretical yield of checks	Theoretical yield of non-check plots	Computed per hectare
Check I (Moro).	105	95	22.9	24.11	25.637	+ 0.37	27.15	27.52	637.03
Moro.	106	95	24.7	26.00	27.15	+ 1.91	27.15	29.06	672.68
Gagayan.	105	96	27.9	29.06	28.67	+ 8.12	27.15	35.27	816.43
Kalayay.	104	95	34.8	36.79					
Check II (Moro)	104	97	29.3	30.23	32.52	+ 1.91	34.83	36.74	850.46
Lobo.	105	97	33.4	34.43	34.84	— 9.11	34.83	25.72	595.36
Ferguson White.	104	89	22.9	25.73	37.16	— 16.38	34.83	18.45	427.08
Ferguson Yellow.	104	89	18.5	20.78					
Check III (Moro).	104	95	37.5	39.47					
Check IV (Moro).	104	95	30.4	32.00					
Baluga.	105	97	30.0	30.92	29.69	+ 1.23	28.52	29.75	688.65
Caluga.	106	96	30.3	31.62	27.37	+ 4.25	28.52	32.77	758.56
Check V (Moro).	104	95	23.8	25.05					
Calamba.	104	96	40.6	42.29	28.13	+ 14.16	31.21	45.37	1,050.23
Bohol.	104	94	38.8	41.27	31.21	+ 10.06	31.21	41.27	955.32
Cebu.	106	93	28.2	30.32	34.29	— 3.97	31.21	27.24	630.55
Check VI (Moro).	106	95	35.5	37.36					



Ferguson Yellow and Ferguson White Dent Corn



(a) Badilla



(b) Barbados

LA CARLOTA EXPERIMENT STATION, OCCIDENTAL NEGROS



(c) Yellow Caledonia

Variety name	Number of days of maturity	Per cent of stand	Yield of grains in kilos							Shelling percentage	
			Actual	Computed yield at 100 per cent stand	Theoretical check of non-check plots	Difference between computed yield at 100 per cent stand and theoretical check yield of non-check plots	Average theoretical yield of checks	Theoretical yield of non-check plots	Computed per hectare		
									Kilogram		Cavan
Check I (Moro)	105	95	15.3	16.10	17.41	— 0.47	18.72	18.25	422.45	7.22	65.18
Moro	106	95	16.1	16.94	18.72	+ 0.55	18.72	19.27	446.06	7.62	66.31
Cagayan	105	96	18.5	19.27	20.03	+ 5.97	18.72	24.69	571.53	9.76	70.97
Kalayay	104	95	24.7	26.00	21.34	—	22.98	23.69	548.38	9.37	66.46
Check II (Moro)	104	97	20.7	21.87	22.16	+ 0.71	22.98	16.18	374.53	6.40	62.88
Lobo	105	97	22.2	22.87	22.98	— 9.31	22.98	13.67	316.43	5.40	69.72
Ferguson White	104	89	14.4	16.18	23.80	—	20.10	21.34	493.98	8.44	69.00
Ferguson Yellow	104	89	12.9	14.49	20.10	+ 1.24	20.10	18.23	421.99	7.21	57.75
Check III (Moro)	104	95	23.4	24.63	21.57	+ 9.03	23.05	32.08	742.59	12.69	72.41
Check IV (Moro)	104	95	18.1	20.10	23.04	+ 6.74	23.05	29.79	689.58	11.78	72.16
Baluga	106	97	20.7	21.34	24.51	— 5.05	23.05	18.00	416.66	7.12	64.18
Calipua	106	96	17.5	18.23	26.00	—					
Check V (Moro)	104	95	19.1	20.10							
Calamba	104	96	29.4	30.60							
Bohol	104	94	28.0	29.78							
Cebu	106	93	18.1	19.46							
Check VI (Moro)	106	95	24.7	26.00							

TABLE 4.—*Dry-season planting, 1922-23*

Variety name	Number of days of maturity	Per cent of stand	Yield of ears in kilos						
			Actual	Computed yield at 100 per cent stands	Theoretical yield at check plots of non-check plots	Difference between computed yield at 100 stand and theoretical check yield of non-check plots	Average theoretical yield of checks	Theoretical yield of non-check plots	Computed per hectare
Check I (Moro).....	115	96	130.30	135.73					
Moro.....	115	96	131.50	136.98	134.31	+ 2.87	132.89	135.56	3,137.96
Batamba.....	115	95	147.50	158.92	132.89	+32.79	132.89	158.92	3,836.18
Bonol.....	115	97	124.85	130.05	131.47	+17.49	132.89	150.38	3,431.01
Check II (Moro).....	96	96	124.85	130.05					
Cebu.....	116	96	129.80	135.21	125.57	+ 9.64	121.09	130.73	3,026.15
Calipus.....	115	84	141.55	168.51	121.09	+47.42	168.09	168.51	3,900.69
Kalaylay.....	117	82	97.90	119.39	116.61	+ 2.75	121.09	123.87	2,867.36
Check III (Moro).....	116	96	107.65	112.13					
Ferguson Yellow.....	115	94	95.20	101.27	117.60	-16.33	123.07	106.74	2,470.83
Ferguson White.....	115	95	122.00	128.42	123.07	+ 6.35	123.07	128.42	2,972.68
Cagayan.....	116	77	81.60	105.97	128.54	-22.57	123.07	100.50	2,326.88
Check IV (Moro).....	116	96	128.60	134.00					

Variety name	Number of days of maturity	Per cent of stand	Yield of grains in kilos								Computed per hectare		Shelling percentage
			Actual	Computed yield at 100 per cent stand	Theoretical check of non-check plots	Difference between computed yield at 100 per cent stand and theoretical check yield of non-check plots	Average theoretical yield of checks	Theoretical yield of non-check plots	Computed per hectare				
									Kilogram	Cavan			
Check I (Moro)	115	96	102.80	107.08									
Moro	115	96	101.50	105.73	109.88	— 4.15	112.68	108.53	2,512.26	42.94	76.42		
Calamba	115	95	129.30	136.11	112.68	+23.43	112.68	136.11	3,150.69	53.85	82.14		
Bohol	115	97	126.30	130.21	115.48	+14.73	112.68	127.41	2,949.30	50.41	80.40		
Check II (Moro)	116	96	113.55	118.28									
Cebu	116	96	104.20	108.54	109.44	- 0.90	100.57	99.67	2,307.17	39.43	80.27		
Calipus	115	84	113.95	135.65	+35.07		100.57	135.64	3,139.81	53.67	80.50		
Kalaylay	117	82	78.40	95.61	91.72	+ 3.89	100.57	104.46	2,418.05	41.33	80.08		
Check III (Moro)	116	96	79.55	82.86									
Ferguson Yellow	115	94	78.20	83.19	84.85	- 1.66	86.85	85.19	1,971.99	33.79	82.14		
Ferguson White	115	95	102.30	107.68	86.84	+20.84	86.85	107.69	2,432.82	42.61	83.85		
Cagayan	116	77	67.20	87.27	88.85	- 1.56	86.85	85.29	1,974.30	33.74	82.35		
Check IV (Moro)	116	96	87.20	90.83									

RESULTS OF THE VARIETY TEST OF SUGAR CANE IN THE YEARS 1921 AND 1922 AT THE LA CARLOTA EXPERIMENT STATION

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This experiment is a continuation of the previous variety test of the Bureau of Agriculture at La Carlota Experiment Station which dates back to 1905. From 1905 to 1912 the test was rather preliminary in nature, consisting principally of the study of the growth and general adaptability of the varieties with regard to vigor, size, stooling, resistance to disease, and other important physical characteristics of each. In 1913 the analysis of each variety was included in the procedure and has been ever since. It consists in the determination of the sucrose content of the juice and of the cane; the apparent purity, glucose, per cent of fiber of the cane; tons of cane to make a ton of sugar; piculs of sugar obtained from a ton of cane; amount of commercial sugar obtainable per hectare and tonnage per hectare of each variety. Accurate information on these points is of the last importance in determining the value of each variety for further propagation by the farmer.

PROCEDURE

In 1912 forty-one varieties of sugar cane, foreign and native, were under observation. Because of the undesirability of many only the more promising varieties were selected for this test and the others were left out. Further observations will be made upon the behavior of those omitted, however; for they may in the long run show some improvement and more adaptability to local conditions. The selected varieties are sixteen in number; five of them native: Negros Purple, a common variety in Negros and Luzon Nos. 1, 2, 3, and 4, which are common in Pampanga. The others are imported varieties: Badilla, Barbados, Big Tanna 3525, Goru or New Guinea 24, Java 247, Louisiana Striped, Malabar, New Guinea 24 A, New Guinea 24 B, Rose Bamboo, and Yellow Caledonia. The Negros Purple being a fairly good yielder has gained a high reputation among the Negros farmers and so it is grown in every hacienda in the province. Because

of its popularity and adaptability in the locality it is taken in this test as the standard variety for comparison. The observations on the varieties are based upon two things: first, plant cane, and second, ratoon.

Plant cane—1921.—A uniform piece of ground rectangular in shape, was plowed on March 1 and again March 15, 1915. After each plowing it was harrowed with disc harrows. On April 1, 1921, it was plowed again and harrowed. The next day it was furrowed. This preparation of the ground was quite late and rather incomplete on account of the shortage of labor at the station at the time. However, the condition of the ground was good enough for planting and on April 8, 1921, this was done. In every two rows or furrows a separate variety was planted. The furrows were 120 centimeters apart and 83 meters long. The points were planted in the furrows 60 centimeters away from each other. Then from time to time the same cultural treatment was given to all varieties. On April 17, 1922, observations were taken. The number of stalks from one hundred stools were taken at random for every variety, to determine the average number of stalks per stool. From these one hundred stools stalks were measured from the base of the cane above the ground up to the first junction of the two lower leaves to find the average height of the stalk of each variety. Samples of each variety were taken into the laboratory for analysis. On April 18, 1922, when twelve months and ten days old, the cane was harvested.

First Ratoon—1922.—Four days after the plant cane had been harvested in 1921 the field was thoroughly cleaned, i. e., the trash was burnt and the field was plowed. The plow was passed close to the stubble so as to give a space for the development of the sprouting shoots. The cultural treatment for all the varieties was the same. On January 24, 1923, the canes were harvested, at the age of nine months and six days. The same procedure was followed as for the 1921 plant cane.

Plant cane—1922.—Another field not very far from the 1921 plant cane was used for the 1922 plant cane. This field was quite weedy, so that a bamboo harrow was passed several times over it before plowing. The work was begun on December 22, 1922. After being harrowed it was plowed six times and harrowed after each plowing. The first two plowings were with disc plows and the others with single mouldboard plows. The varieties were planted on April 20, 1922. The same procedure throughout was followed as for the 1921 plant cane. This

planting was late because there were no points available except those that were to be taken from the 1921 planting, and the 1921 planting was not harvested until April because of the fact that the canes were allowed to attain the age of twelve months or more before they were cut.

On December 8 of the same year the canes of this 1922 planting were harvested though they had not attained full maturity, for by this time the canes were only seven months and eighteen days old. This was done for two reasons: (1) to determine the production of each variety after seven months planted, and (2) to have an early planting for the other test (1923) as there is no other source of seeds but this and the ratoon field.

RESULTS

TABLE 1.—Showing results of analysis of the 1921-plant cane (12 months and 10 days old).

Variety name	Juice				Cane		Extraction by hand mill	Tons cane per ton sugar	Piculs sugar per ton cane
	Corrected brix	Polarization	Approximate purity	Glucose	Fiber	Sucrose			
1. Badila.....	20.91	<i>P. ct.</i> 20.00	95.6	1.11	<i>P. ct.</i> 7.92	16.89	60.38	6.36	2.51
2. Barbados.....	17.81	16.48	92.5	1.32	9.47	13.89	62.14	7.87	2.02
3. Big Tanna 3525.....	16.81	13.63	81.0	1.05	9.40	12.04	63.46	10.14	1.56
4. Goru or New Guinea 24.....	17.91	15.83	88.4	1.23	9.08	13.51	62.15	8.35	1.90
5. Java 247.....	18.89	16.24	85.9	1.04	9.53	13.08	56.68	8.25	1.92
6. Luzon No. 1.....	19.68	18.07	91.8	1.21	9.71	15.40	57.78	7.18	2.22
7. Luzon No. 2.....	18.78	16.00	85.1	1.12	9.50	13.60	56.27	8.40	1.88
8. Luzon No. 3.....	18.18	14.80	81.4	.89	7.46	12.60	62.72	9.28	1.71
9. Luzon No. 4.....	18.21	15.13	83.0	1.03	7.50	12.90	62.50	9.02	1.75
10. Louisiana Striped.....	20.71	18.10	87.3	1.13	9.68	15.40	61.29	7.83	2.16
11. Malabar.....	17.38	14.90	85.7	1.04	9.20	12.70	60.00	8.99	1.77
12. Negros Purple.....	18.61	15.88	85.3	1.04	11.09	12.03	58.92	8.53	1.86
13. New Guinea 24 A.....	17.64	15.82	89.6	1.16	11.38	13.06	64.97	8.30	1.90
14. New Guinea 24 B.....	16.99	15.31	90.1	1.30	10.83	13.12	61.29	8.53	1.86
15. Rose Bamboo.....	16.17	13.26	82.0	1.92	12.05	7.19	60.02	10.38	1.53
16. Yellow Caledonia.....	16.64	13.18	79.2	1.47	10.89	8.68	61.88	10.68	1.49

TABLE 2.—Showing yield of the 1921-plant cane (12 months and 10 days old)

Variety name	Average number of stalks per stool	Average height of stalks	Average weight of stalks	Computed yield of cane per hectare		Computed piculs of sugar per hectare
				<i>Centimeters</i> Kilos	Tons	
1. Badila.....	7	174	.98	65.00	163.15	
2. Barbados.....	6	185	.95	62.50	126.25	
3. Big Tanna 3525.....	6	133	1.46	58.75	91.65	
4. Goru or New Guinea 24.....	6	238	.59	60.00	114.00	
5. Java 247.....	5	169	1.15	60.65	116.44	
6. Luzon No. 1.....	6	138	1.26	57.25	127.09	
7. Luzon No. 2.....	4	130	1.04	63.50	119.38	
8. Luzon No. 3.....	3	166	.86	61.50	105.16	
9. Luzon No. 4.....	6	164	.86	62.12	108.71	
10. Louisiana Striped.....	6	142	.77	48.75	105.30	
11. Malabar.....	4	173	1.77	60.00	106.20	
12. Negros Purple.....	6	163	.63	38.75	72.07	
13. New Guinea 24 A.....	6	178	.81	62.25	118.27	
14. New Guinea 24 B.....	4	147	.98	48.75	90.67	
15. Rose Bamboo.....	6	115	1.36	42.50	65.02	
16. Yellow Caledonia.....	5	192	2.03	60.00	89.40	

TABLE 3.—Showing results of analysis of the 1922 ratoon,
(9 months and 6 days old)

Variety name	Juice				Cane		Extraction by hand mill	Tons cane per ton sugar	Piculs sugar per ton cane
	Corrected brix	Polarization	Approximate purity	Glucose	Fiber	Sucrose			
1. Badilla	19.15	<i>P. ct.</i> 17.30	90.3	1.22	<i>P. ct.</i> 9.56	<i>P. ct.</i> 14.36	<i>P. ct.</i> 62.50	7.54	2.10
2. Barbados	14.14	12.11	83.6	.96	9.12	10.05	61.08	11.20	1.41
3. Big Tanna 3525	15.17	13.42	88.4	1.12	7.16	11.16	64.18	9.84	1.61
4. Goru or New Guinea 24	16.84	14.95	88.0	.88	12.00	10.77	57.14	8.86	1.70
5. Java 247	19.83	18.50	93.2	1.06	10.27	15.20	58.93	6.96	2.29
6. Luzon No. 1	16.11	13.73	81.1	.84	10.55	11.39	60.00	9.81	1.61
7. Luzon No. 2	19.71	17.80	90.3	1.17	11.00	14.19	59.26	7.33	2.16
8. Luzon No. 3	16.57	14.02	87.2	1.07	11.34	11.08	61.15	9.49	1.68
9. Luzon No. 4	16.17	13.86	85.7	.86	10.23	12.72	64.29	9.71	1.62
10. Louisiana Striped	15.07	12.80	84.8	.86	10.88	10.50	61.41	10.48	1.52
11. Malabar	16.61	13.61	82.0	1.09	9.04	11.70	65.22	10.07	1.58
12. Negros Purple	18.47	16.26	88.0	.83	9.29	13.49	61.40	8.15	1.95
13. New Guinea 24 A	17.61	15.38	87.3	1.17	9.53	12.76	64.70	8.66	1.83
14. New Guinea 24 B	18.21	15.43	84.7	.88	8.25	12.86	64.71	8.74	1.81
15. Rose Bamboo	17.47	15.11	86.5	.87	11.10	12.54	63.00	8.83	1.79
16. Yellow Caledonia	17.97	14.82	83.4	1.20	10.40	12.30	60.76	9.16	1.73

TABLE 4.—Showing yield of the 1922 ratoon (9 months and 6 days old)

Variety name	Average Number of stalk per stool	Average height of stalk	Average weight of stalk	Computed yield of cane per hectare	Computed piculs of sugar per hectare
		Centimeters	Kilos	Tons	
1. Badilla	4	90	.85	56.66	118.98
2. Barbados	4	93	.66	23.33	32.89
3. Big Tanna 3525	5	79	.63	49.99	78.48
4. Goru or New Guinea 24	4	122	.48	39.66	70.99
5. Java 247	5	104	.72	46.49	106.46
6. Luzon No. 1	3	87	.41	31.27	50.34
7. Luzon No. 2	4	89	.67	33.75	72.90
8. Luzon No. 3	3	78	.57	28.75	48.80
9. Luzon No. 4	7	68	.53	26.85	43.49
10. Louisiana Striped	5	72	.54	23.49	37.70
11. Malabar	5	79	.93	38.33	60.56
12. Negros Purple	5	56	.59	29.32	57.17
13. New Guinea 24 A	6	61	.85	42.89	78.48
14. New Guinea 24 B	5	47	.59	36.65	66.33
15. Rose Bamboo	4	86	.44	32.50	58.17
16. Yellow Caledonia	4	124	1.19	40.55	60.15

TABLE 5.—Showing results of analysis of 1922-plant cane
(7 months and 18 days old)

Variety name	Juice				Cane		Extraction by hand mill	Tons cane per ton sugar	Piculs sugar per ton cane
	Corrected brix	Polarization	Approximate purity	Glucose	Fiber	Sucrose			
1. Badilla	15.19	<i>P. ct.</i> 10.99	72.3	1.18	<i>P. ct.</i> 9.61	<i>P. ct.</i> 8.20	<i>P. ct.</i> 69.49	13.99	1.13
2. Barbados	15.74	12.37	78.5	.96	12.50	9.23	66.83	10.40	1.51
3. Big Tanna 3525	13.09	8.45	64.5	1.42	11.11	6.29	66.81	21.36	.74
4. Goru or New Guinea 24	17.04	14.06	82.5	1.11	8.87	10.51	73.52	9.52	1.66
5. Java 247	15.18	11.94	78.6	1.32	13.18	8.92	62.53	11.71	1.35
6. Luzon No. 1	12.79	8.98	70.2	1.62	9.96	6.70	62.99	17.76	.89
7. Luzon No. 2	15.79	13.10	82.9	.91	11.66	9.78	58.35	10.13	1.56
8. Luzon No. 3	15.89	13.55	85.2	.56	13.55	10.14	55.10	9.58	1.65
9. Luzon No. 4	14.12	11.30	80.0	1.07	12.61	9.86	60.20	12.15	1.80
10. Louisiana Striped	13.49	8.67	64.2	1.45	9.30	7.10	63.51	19.28	.82
11. Malabar	13.59	9.92	72.9	.72	12.25	7.42	64.28	15.34	1.03
12. Negros Purple	11.29	6.71	59.4	1.30	10.00	5.00	64.28	30.94	.51
13. New Guinea 24 A	12.14	7.71	63.5	1.55	8.24	5.75	76.25	23.95	.66
14. New Guinea 24 B	14.24	10.14	71.2	1.30	11.54	7.57	67.48	15.48	1.02
15. Rose Bamboo	14.89	11.59	77.8	1.13	8.24	8.67	59.79	12.17	1.29
16. Yellow Caledonia	10.59	5.66	53.4	1.30	12.02	4.22	65.85	46.50	.34

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TABLE 6.—Showing yield of the 1922-plant cane (7 months and 18 days old)

Variety name	Average number of stalks per stool	Average height of stalks	Average weight of stalks	Computed yield of cane per hectare	Computed piculs of sugar per hectare
		<i>Centimeters</i>	<i>Kilos</i>	<i>Tons</i>	
1. Badila.....	5	183	1.30	17.16	19.37
2. Barbados.....	5	152	1.00	14.76	22.25
3. Big Tanna 3525.....	5	153	.94	17.01	12.58
4. Goru or New Guinea 24.....	4	178	1.20	25.01	41.63
5. Java 247.....	5	164	.97	23.69	32.01
6. Luzon No. 1.....	3	117	.86	23.11	20.52
7. Luzon No. 2.....	4	125	.62	22.99	38.98
8. Luzon No. 3.....	3	122	.64	22.73	37.54
9. Luzon No. 4.....	7	149	.71	16.19	21.06
10. Louisiana Striped.....	5	128	.78	15.57	12.84
11. Malabar.....	5	132	.96	19.50	20.08
12. Negros Purple.....	5	112	.62	15.02	7.65
13. New Guinea 24 A.....	5	158	.83	20.93	13.75
14. New Guinea 24 B.....	5	144	.78	22.84	23.40
15. Rose Bamboo.....	5	114	.52	11.73	15.18
16. Yellow Caledonia.....	6	159	1.40	15.15	5.10

TABLE 7.—Showing results of analysis of the three crops

Variety name	Juice			Cane		Piculs of sugar per ton cane
	Polarization	Approximate purity	Glucose	Fiber	Sucrose	
	<i>P. ct.</i>			<i>P. ct.</i>	<i>P. ct.</i>	
1. Badila.....	16.07	86.0	1.17	9.03	13.14	1.91
2. Barbados.....	13.65	85.8	1.08	10.36	11.05	1.64
3. Big Tanna 3525.....	11.83	77.9	1.19	9.22	9.83	1.30
4. Goru or New Guinea 24.....	14.94	86.3	1.07	9.98	11.59	1.78
5. Java 247.....	15.56	85.9	1.14	10.99	12.40	1.85
6. Luzon No. 1.....	13.59	81.0	1.22	10.07	11.16	1.57
7. Luzon No. 2.....	15.53	86.1	1.06	10.72	12.52	1.86
8. Luzon No. 3.....	14.12	84.6	.84	10.78	11.27	1.68
9. Luzon No. 4.....	13.43	82.9	.98	10.12	11.82	1.55
10. Louisiana Striped.....	13.19	78.7	1.14	9.78	11.00	1.50
11. Malabar.....	12.81	80.2	.95	10.16	10.60	1.46
12. Negros Purple.....	12.95	77.5	1.05	10.12	10.17	1.44
13. New Guinea 24 A.....	12.97	80.1	1.29	9.70	10.52	1.46
14. New Guinea 24 B.....	13.62	82.0	1.16	10.20	11.18	1.56
15. Rose Bamboo.....	13.32	82.1	1.30	10.46	9.46	1.53
16. Yellow Caledonia.....	11.22	72.0	1.32	11.10	8.40	1.13

TABLE 8.—Showing average yield of the three crops

Variety name	Average number of stalks per stool	Average height of stalks	Average weight of stalks	Computed yield of cane per hectare	Computed piculs of sugar per hectare
		<i>Centimeters</i>	<i>Kilos</i>	<i>Tons</i>	
1. Badila.....	5	132.33	1.04	46.27	100.50
2. Barbados.....	5	143.33	.87	33.53	60.46
3. Big Tanna 3525.....	5	121.66	1.01	41.91	60.90
4. Goru or New Guinea 24.....	4	179.33	.75	41.56	75.54
5. Java 247.....	5	145.66	.94	43.61	64.97
6. Luzon No. 1.....	4	114.00	.84	37.21	65.98
7. Luzon No. 2.....	4	114.66	.77	40.58	77.09
8. Luzon No. 3.....	3	122.00	.69	37.66	62.70
9. Luzon No. 4.....	6	127.00	.70	37.05	57.72
10. Louisiana Striped.....	5	114.00	.69	29.27	51.95
11. Malabar.....	4	128.00	.84	39.28	62.27
12. Negros Purple.....	5	110.33	.61	27.67	45.63
13. New Guinea 24 A.....	6	134.00	.83	42.02	70.17
14. New Guinea 24 B.....	4	112.66	.78	36.08	60.13
15. Rose Bamboo.....	4	105.00	.77	28.91	46.12
16. Yellow Caledonia.....	5	158.33	1.54	38.66	51.55

DISCUSSION OF RESULTS

Tables 1, 3, and 5 represent the results of the 1921-plant cane, 1922-ratoon cane and 1922-plant cane analyses, respectively. The age of the canes varied for each crop—from 7 months and 18 days old in 1922-plant cane to 12 months and 10 days in 1921-plant cane. At the age of 12 months and 18 days Badila, Barbados, Luzon No. 1, and Louisiana Striped produced more than two piculs of sugar for every ton of cane. Badila had the highest, 2.51 piculs per ton cane and the lowest among the four varieties was Barbados, which gave 2.02 piculs per ton cane. The rest of the varieties ranged from 1.49 to 1.92 piculs per ton cane. Rose Bamboo, Yellow Caledonia, Malabar, Luzon No. 3, Luzon No. 4, and Big Tanna 3525 produced even less than Negros Purple, while the others gave equal or even more than this standard variety. In the ratoon (1922-Ratoon) only Badila, Java 247, and Luzon No. 2 have exceeded Negros Purple in piculs of sugar per ton cane. The rest have shown lower equivalents of sugar per ton cane than the standard variety. But harvesting at an earlier time Negros Purple of 1922 plant cane has produced even less than this—.34 picul only. Goru or New Guinea 24, Barbados, Luzon No. 2, and Luzon No. 3 have the four highest equivalence. It ranges from 1.51 to 1.66 piculs per ton cane. This difference of piculs per ton cane of each variety may be noted by the purity of the variety. As a matter of fact plant cane of the Yellow Caledonia in the two plantings has been shown to contain low purity which indicates also that it has a low sucrose content and consequently has the least number of piculs per ton cane.

The tonnage and sugar equivalence per hectare of each variety of 1921-plant cane, 1922-ratoon cane, and 1922-plant cane are represented in Tables 2, 4, and 6, respectively. This is graphically illustrated in Fig. 6. In the graph the piculs of sugar per hectare produced and the tonnage production of cane per hectare are indicated. The 1921-plant cane shows that all the other varieties except the Rose Bamboo gave a higher tonnage than the Negros Purple. In this graph it may be seen that Badila occupies the highest point both in tonnage and sugar per hectare. In terms of sugar production Luzon No. 1 follows the Badila, the former giving 127.09 piculs of sugar supposed to be 96° test while Badila gave 163.15 piculs of the same kind of sugar. In tonnage production of cane per hectare Luzon No. 2 with 63.5 tons and New Guinea 24 A with 62.25 tons of cane per hectare follow Badila, which produced

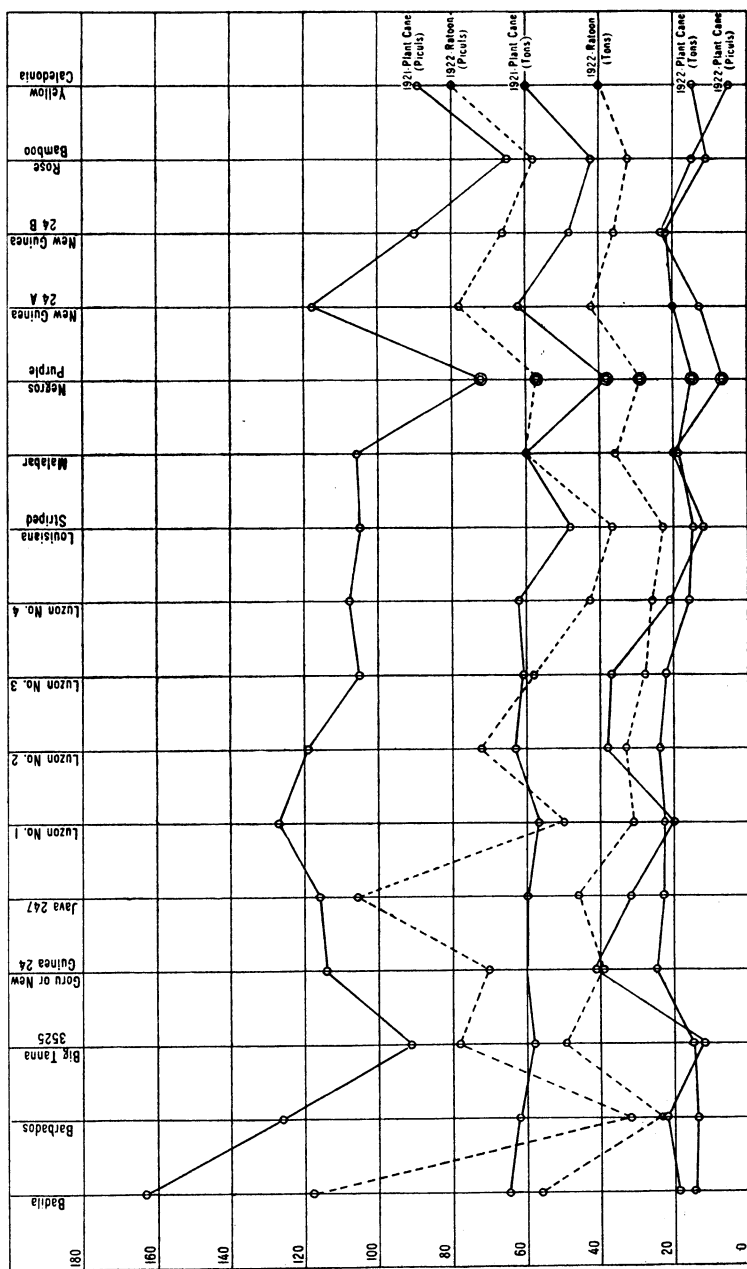


Fig. 6. Graph showing piculs and tons of cane per hectare

65 tons of cane per hectare. These two varieties occupy third place in sugar production also.

The graph also illustrates the 1922-ratoon canes. In this illustration Badila again, Java 247 and Yellow Caledonia lead. They produced more than 80 piculs of sugar per hectare. This demonstrates that these three varieties are the best yielders for ratoon crop. Among the native varieties Luzon No. 2 and Luzon No. 3 compete with the standard variety in sugar production. It is evident also that the foreign varieties Big Tanna 3525, Goru, Malabar, New Guinea 24 A, New Guinea 24 B, and Rose Bamboo in the order given exceeded Negros Purple in ratooning power. They gave more piculs of sugar than the latter.

When harvesting plant canes at the age of more than 7 months, Goru leads in the production of sugar. This variety contains the highest sucrose content as seen in Table 5 and the purity is fair. Luzon No. 2, Luzon No. 3, and Java 247 rank next Goru in sugar production. However, all, with the exception of Yellow Caledonia gave a higher production than Negros Purple. In this crop Badila occupies only the tenth place, which shows that it should not be cut under nine months. Goru, Luzon No. 2, and Luzon No. 3 and Java 247 may be harvested as early as 7 months after planting. Yellow Caledonia is proving to be a late maturing variety, for when cut after 7 months of planting it had the lowest purity and sucrose content and consequently produced the least sugar—5.10 piculs per hectare. This is but little better than what the other varieties give four months after planting. The rest show themselves good for 12 months before they need to be cut.

Table 7 shows the average results of analysis of the three crops. In this table, therefore, it can be noted that Badila still gives the highest sucrose content (16.07 per cent) and purity (86.0), consequently a high number of piculs of sugar per ton cane (1.91). It has the lowest per cent of fiber (9.03 per cent) in the group. The Luzon varieties compete favorably in sucrose content with the foreign variety. They show a purity of more than 80. Their percentage of fiber is around 10 per cent. Yellow Caledonia has the highest fiber content (11.1 per cent) in the cane.

Again the yield of each variety for the three crops was also average, as shown in Table 8. In this table New Guinea 24 A and Luzon No. 1 have the highest number of stalks per stool. Badila, Barbados, Big Tanna 3525, Java 247, Louisiana Striped,

and Yellow Caledonia have only 5 stalks per stool the same number as Negros Purple. Luzon No. 3 has only 3, the smallest number of all. The rest have 4 each. The longest variety is Goru, which is 179.33 centimeters, and the shortest is Rose Bamboo, with 105 centimeters long. The longest is 69 centimeters longer than the established standard variety and the shortest shows a difference of 5.32 centimeters below the same variety, Negros Purple. Yellow Caledonia has an average weight of 1.54 kilos per stalk. It is the heaviest of all the varieties. Badila weighs 1.04 kilos and Big Tanna 3525 weighs 1.01 kilos. These two (Badila and Big Tanna) follow Yellow Caledonia in weight. The rest are below one kilo and Negros Purple is the lightest of all.

The average tonnage and sugar yield are graphically illustrated in Fig. 7. The solid line represents the piculs of sugar per hectare and the dotted lines the tonnage per hectare. It is obvious from this graph how Badila exceeds in production the other varieties and especially the Negros Purple. It exceeds them all in tonnage and sugar production. The next highest in sugar yield is a native variety, Luzon No. 2, then the others rank in order as follows: Goru, New Guinea 24 A, Luzon No. 1, Java 247, Luzon No. 3, Big Tanna 2525, Barbados, New Guinea 24 B, Luzon No. 4, Louisiana Striped, Yellow Caledonia, Rose Bamboo, and lastly Negros Purple the established standard variety.

Luzon No. 2 has even less tonnage of cane than Java 247, Big Tanna 3525 and New Guinea 24 A, but its sugar yield is higher than any of the three. With Yellow Caledonia, Rose Bamboo, and Negros Purple it is the reverse. As shown in Table 7, Yellow Caledonia has an average of 11.22 per cent sucrose or per cent polarization and 72 purity, while Rose Bamboo has 13.32 per cent sucrose and 82.1 purity and Negros Purple 12.95 per cent sucrose or per cent polarization and 77.5 purity, both of which showing higher purity and sucrose content than the Yellow Caledonia. But the sugar production of Yellow Caledonia is greater than that of either of the two because of its increased tonnage. In the same table, it may be noted that Badila has 16.07 per cent sucrose or per cent polarization and 86 per cent purity. These figures represent the highest of all the figures in their respective columns and Badila also has the highest tonnage and so the sugar yield has increased considerably in comparison with the others especially the Negros Purple. This shows therefore that high sucrose content

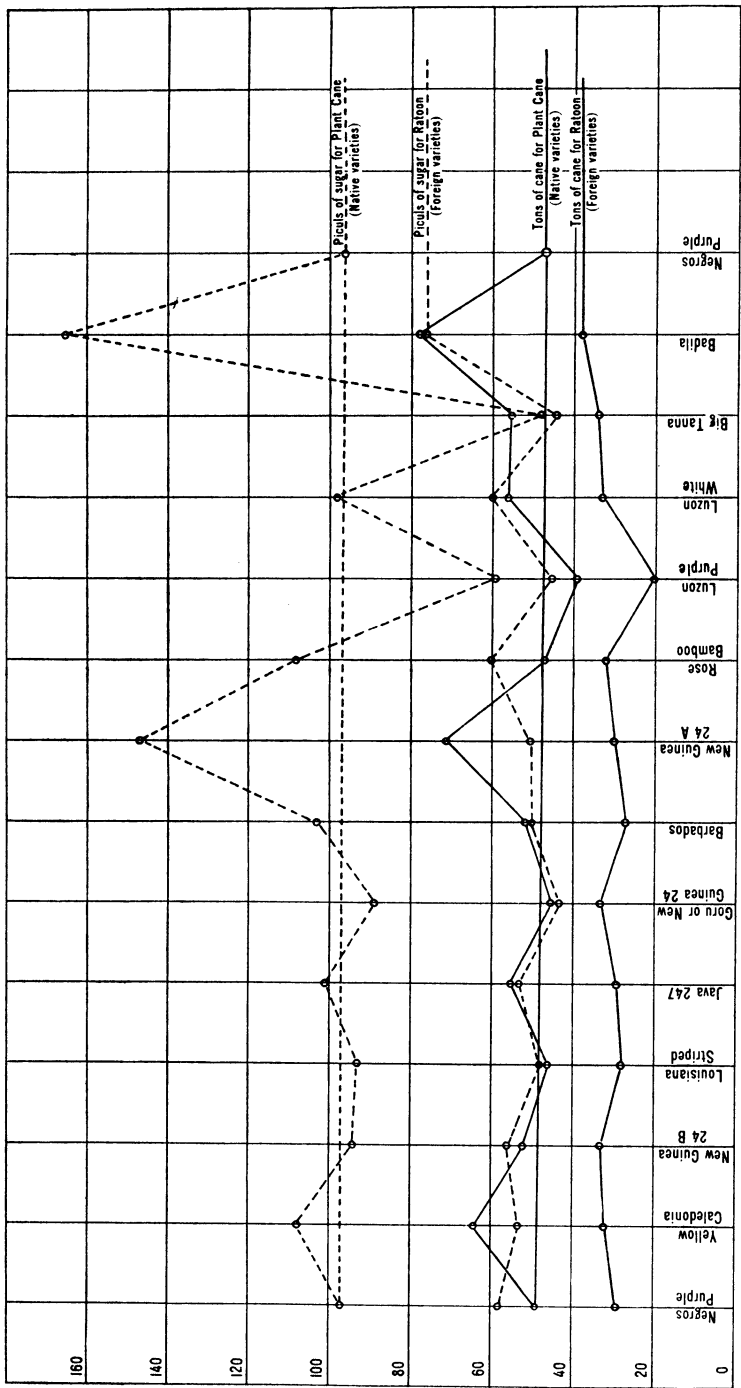


Fig. 7. Graph showing tons of cane and piculs of sugar per hectare for the crop year 1922-23

and tonnage yield are the important factors from which to judge whether which variety will give the most commercial sugar of 96° test.

SUMMARY

1. Badila is the best yielder of all, giving an average yield of 100.5 piculs of sugar per hectare. The production is more than double that of Negros Purple, which is only 45.63 piculs per hectare. Besides it has a better ratooning power than the others.

2. Luzon No. 1, Luzon No. 2, New Guinea 24 A, Goru or New Guinea 24, and Java 247 are the next to Badila in production. Their yields range between 65.98 and 77.09 piculs per hectare. The rest compare favorably with Negros Purple.

3. Java 247, Yellow Caledonia, New Guinea 24 A, Big Tanna 3525, Goru or New Guinea 24, Luzon No. 2, Malabar, Luzon No. 3, and Rose Bamboo have also good ratooning power. They have more piculs of sugar per hectare than the established standard variety, Negros Purple, which is only 57.17 piculs of sugar per hectare.

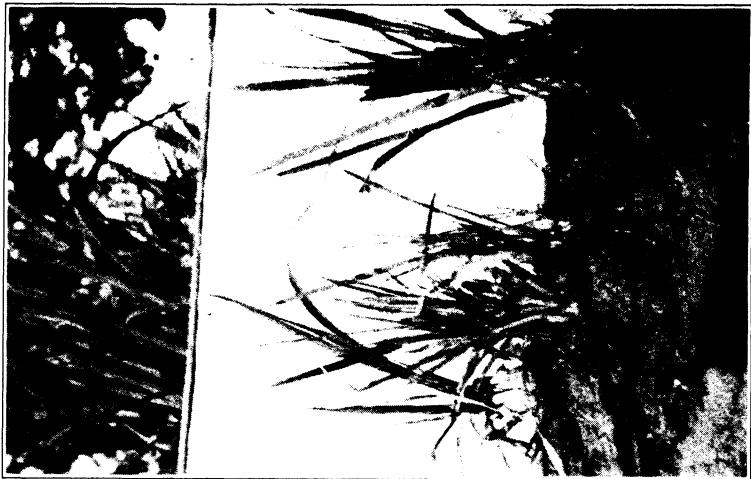
4. Harvesting the plant canes after 7 months or so, Goru, or New Guinea 24, Luzon No. 2, Luzon No. 3, and Java 247 are the leading varieties. The yields range from 32.01 piculs for Java 247, the lowest; to 41.63 piculs for Goru, the highest.

5. Badila should not be cut until nine months, but Goru or New Guinea 24, Luzon No. 2, and Java 247 may be harvested as early as 7 months after planting. Yellow Caledonia is a late maturing variety and should not be cut when less than 12 months old. Barbados, Big Tanna 3525, Java 247, Luzon No. 1, Luzon No. 4, Louisiana Striped, Malabar, New Guinea 24 A, New Guinea 24 B, and Rose Bamboo should be cut at the same age as Negros Purple is cut—usually 12 months after planting.

6. Native varieties can compete with the foreign varieties. They closely follow the high yielders among the foreign varieties.



(a) Hawaiian-109, affected with Fiji disease



(b) Hawaiian-227, affected with Fiji disease

RESULTS OF THE VARIETY TEST OF SUGAR CANE AT LA CARLOTA EXPERIMENT STATION FOR THE CROP YEARS 1922-23

By S. ASUNCION AND M. MEDINA

This experiment was a continuation of the variety test of 1921-22.

Ratoon.—The trash from the 1922 plant canes used in the last year's test were burned on December 19, 1922, after the crops was harvested to clean the field and thus hasten the sprouting of the shoots. Ten days afterwards when all the shoots had appeared above ground a plow was passed near the rows, off-barring them so as to loosen the earth around the mother plants. The proper and necessary cultivation was given to all the varieties, thenceforth.

The harvesting lasted from January 14 to 20, 1924, the varieties being then 13 months and 27 days old. The canes of each variety were weighed on a Fairbanks scale and the yield per hectare calculated from the weights.

Samples for analysis were also taken from each variety before they were mixed. The amount of sugar per hectare was estimated by the method used in the distribution of sugar sketched by Carlos L. Locsin in a chart given in the December number (1923) of Sugar News: "Sucrose available in any planter's cane is equal to $HK-BL$; where H is equal to the polarization of the crusher juice of the planter, B is equal to the brix of the crusher juice of the planter K and L are constants." The value of the constants was determined from the mill data obtained from La Carlota Central during the time these canes were being milled.

TABLE 1.—Analysis of ratoon 13 months and 27 days old

Plot No.	Variety name	Brix	Sucrose	Apparent purity	Piculs of sugar ton cane	Fiber in cane
			<i>Per cent</i>			<i>Per cent</i>
1	Negros Purple	17.5	15.8	90.3	1.97	11.4
2	Yellow Caledonia	16.0	13.6	85.4	1.64	11.7
3	New Guinea-24 B	17.1	14.1	85.7	1.72	12.6
4	Louisiana Striped	16.0	13.8	86.7	1.69	10.8
5	Java-247	17.4	15.1	87.1	1.82	12.0
6	Goru (New Guinea-24)	18.5	13.1	71.0	1.29	11.9
7	Barbados	15.6	14.6	93.8	1.85	13.3
8	New Guinea-24 A	15.9	13.9	87.7	1.69	13.9
9	Rose Bamboo	16.9	15.2	90.1	1.88	12.6
10	Luzon Purple (Luzon-1)	18.1	16.5	91.4	2.16	12.4
11	Luzon White (Luzon-2)	16.4	14.6	89.1	1.80	12.6
12	Big Tanna	15.0	11.6	77.7	1.29	12.6
13	Badila	18.5	16.2	87.6	1.99	7.9

TABLE 2.—Yield of ratoon 13 months and 27 days old

Plot No.	Variety name	Actual tons of cane	Calculated tons of cane per hectare	Calculated piculs of sugar per hectare	Comparative difference with Negros Purple	
					Tons of cane per hectare	Piculs of sugar per hectare
1	Negros Purple	.368	29.44	58.00		
2	Yellow Caledonia	.404	32.32	53.00	+2.88	— 5.00
3	New Guinea-24 B	.414	33.12	56.97	+3.68	— 1.03
4	Louisiana Striped	.361	28.88	48.81	— .56	— 9.19
5	Java-247	.367	29.36	53.44	— .08	— 4.56
6	Goru (New Guinea-24)	.423	33.84	43.65	+4.40	—14.35
7	Barbados	.342	27.36	50.62	—2.07	— 7.38
8	New Guinea-24 A	.376	30.08	50.84	+ .64	— 7.16
9	Rose Bamboo	.403	32.24	60.61	+2.80	+ 2.61
10	Luzon Purple (Luzon-1)	.262	20.96	45.27	—8.48	—12.73
11	Luzon white (Luzon-2)	.419	33.52	60.34	+4.08	+ 2.34
12	Big Tanna	.428	34.24	44.12	+4.80	—13.83
13	Badila	.481	38.48	76.58	+9.04	+18.58

The analysis together with the number of piculs of sugar per ton cane is given in Table 1. The actual yield of cane per plot, the calculated number of tons of cane and piculs of sugar per hectare of each variety are shown in the first three columns in Table 2, and are graphically illustrated in Fig. 1. A comparison of the varieties with Negros Purple as to tonnage and sugar yield per hectare was made and the comparative differences are shown in the last two columns of Table 2.

The high yielder variety both in tonnage and sugar was Badila, which gave 38.48 tons of cane and 76.58 piculs of sugar. Luzon Purple gave the lowest—20.96 tons of cane and 45.27 piculs of sugar per hectare. It may be noted in the tonnage production of canes that Louisiana Striped, Java-247, Barbados, and Luzon Purple are the only varieties below Negros Purple. But in sugar yield there are only three that surpassed Negros Purple. These are Luzon White, with an increase of 2.34 piculs; Rose Bamboo, 2.61 piculs; and Badila, 18.58 piculs of sugar more than Negros Purple. This shows that except for the three varieties mentioned none of them equaled Negros Purple in the ratooning power during this test.

Plant cane.—An almost rectangular field containing 16,356 square meters (120×136.3 meters) was measured for this experiment. The field was plowed five times with mould board plows and harrowed after each plowing. When it was ready for planting it was divided into 25 equal plots of 654 square meters each. The width of each plot was 4.8 meters so that 4 rows 1.2 meter apart were contained in each plot. In each row the points were planted in hills 40 centimeters apart. The plots were made long and narrow so that the varieties would be more or less close to each other and practically under the

same climatic and soil conditions. They were numbered from 1 to 25.

On December 14, 1922, Badila, Big Tanna, Luzon Purple, Luzon White, Rose Bamboo, New Guinea-24 A, New Guinea-24 B, Barbados, Goru (New Guinea-24), Yellow Caledonia, Java-247, Louisiana Striped, and Negros Purple were planted. Negros Purple was again used as the check variety. It was planted alternately with each of the other varieties, occupying all the odd-numbered plots. This was done in order to get a closer check. Proper and similar cultural treatments were given to all the plots.

Harvesting was done from January 22 to February 1, 1924, when the varieties were 13 months and 21 days old. Each variety was loaded separately on cars for milling in La Carlota Central. The Central's chemist was kind enough to make the analysis of each variety and all the necessary analytical calculations pertaining to same.

TABLE 3.—*Analysis of plant cane 13 months and 21 days old*

Plot No.	Variety name	Brix	Sucrose	Apparent purity	Piculs of sugar per ton cane	Fiber in cane
			<i>Per cent</i>			<i>Per cent</i>
1	Negros Purple.....	18.4	16.4	89.1	1.98	10.3
2	Yellow Caledonia.....	18.5	15.1	79.4	1.67	10.4
4	New Guinea-24 B.....	17.8	15.2	85.4	1.82	11.9
6	Louisiana Striped.....	19.8	16.9	85.5	2.01	11.3
8	Java-247.....	20.2	16.5	81.7	1.85	13.4
10	Goru (New Guinea-24).....	19.4	16.8	85.6	1.98	11.3
12	Barbados.....	20.1	17.1	85.1	2.82	11.6
14	New Guinea-24 A.....	19.1	17.0	89.0	2.87	11.4
16	Rose Bamboo.....	19.5	17.4	89.2	2.18	8.9
18	Luzon Purple (Luzon-1).....	16.9	13.4	79.4	1.51	10.8
20	Luzon white (Luzon-2).....	18.3	15.1	82.5	1.75	11.3
22	Big Tanna.....	15.0	10.6	70.7	0.88	12.0
24	Badila.....	19.3	17.0	88.4	2.10	9.7
25	Negros Purple.....	18.4	16.4	89.1	2.01	10.3

TABLE 4.—*Yield of plant cane 13 months and 21 days old*

Plot No.	Variety name	Actual tons of cane	Calculated tons of cane per hectare	Calculated piculs of sugar per hectare	Comparative difference with Negros Purple	
					Tons of cane per hectare	Piculs of sugar per hectare
1	Negros Purple.....	3.213	49.12	97.25	.....	.....
2	Yellow Caledonia.....	4.198	64.19	108.26	+ 15.64	+ 11.41
4	New Guinea-24 B.....	3.407	52.07	94.76	+ 3.52	+ 2.09
6	Louisiana Striped.....	3.046	46.57	93.60	- 1.98	- 3.25
8	Java-247.....	3.600	55.04	101.82	+ 6.49	+ 4.97
10	Goru (New Guinea-24).....	2.950	45.10	89.29	- 3.45	- 6.56
12	Barbados.....	3.358	51.34	103.70	+ 2.79	+ 6.85
14	New Guinea-24 A.....	4.657	71.20	147.38	+ 22.65	+ 50.53
16	Rose Bamboo.....	3.094	47.30	108.11	- 1.25	+ 11.26
18	Luzon Purple (Luzon-1).....	2.565	39.22	59.24	- 9.33	- 37.61
20	Luzon White (Luzon-2).....	3.667	56.07	98.42	+ 7.52	+ 1.57
22	Big Tanna.....	3.623	55.40	48.86	+ 6.85	- 47.99
24	Badila.....	5.153	78.80	165.48	+ 30.25	+ 68.63
25	Negros Purple.....	3.139	47.99	96.45	.....	.....
	Average Negros Purple.....	.....	48.55	96.85	.....	.....

Table 3 is self-explanatory.

Table 4 gives the actual yield of cane per plot and the computed yield of cane and sugar per hectare of each variety. In this table it may be noted that the yields of Negros Purple in plots 1 and 25 are almost the same—49.12 tons of cane and 97.25 piculs of sugar for Plot 1 and 47.99 tons of cane and 96.45 piculs of sugar for Plot 25. The similarity of these check yields reveals the uniformity of soil fertility in this field used from Plot 1 to Plot 25, i. e. from one end to the other. And with similar soil conditions an accurate comparison between the varieties can be made.

In the last two columns of Table 4 are given the comparative differences between each variety and the average yield of the two check plots of Negros Purple. The varieties surpassing Negros Purple in tonnage production of cane per hectare are Badila, the highest; New Guinea-24 A, the second; Yellow Caledonia, third; then followed by Luzon White, Big Tanna, Java-247, New Guinea-24 B, and Barbados. The increase in tonnage varies from 2.79 to 30.25 tons of cane. Luzon Purple, Goru (New Guinea-24), Louisiana Striped, and Rose Bamboo gave a lower tonnage than the average of the Negros Purple. The difference ranges from 1.25 to 9.33 tons of cane.

In terms of piculs of sugar Badila again occupies the first place, with 165.48 piculs of sugar per hectare, or 68.63 piculs of sugar more than Negros Purple. New Guinea-24 A comes second, with 147.38 piculs of sugar per hectare, or an increase of 50.53 piculs of sugar over the check variety. The third is Yellow Caledonia, with 108.26 piculs of sugar per hectare, or an increase of 11.41 piculs over Negros Purple. Rose Bamboo came out with a surprisingly large yield of sugar—108.11 piculs out of its yield per hectare of 47.30 tons of cane. This variety of Rose Bamboo is really good because it produces comparatively less cane and more sugar. Barbados, Java-247, and Luzon White each gave a little more than the check. Big Tanna has proved to be the poorest of all the varieties. Out of 55.4 tons of cane only 48.88 piculs of sugar cane produced, a yield of 47.99 piculs less than that of the check variety.

SUMMARY

1. Badila was again the heaviest yielder, giving 78.80 tons of cane and 165.48 piculs of sugar per hectare. And again showed the greatest ratooning power.

2. New Guinea-24 A, Yellow Caledonia, and Rose Bamboo showed a considerable increase in production as compared with Negros Purple.

3. Yellow Caledonia is a heavy cane producer but the amount of sugar is rather small in proportion, while Rose Bamboo is the reverse, i. e. less cane and more sugar. It is therefore considered better than the former. Yellow Caledonia gave an increase of 16.89 tons over Rose Bamboo yet the increase in sugar was 0.15 picul.

4. Java-247, Barbados, and Luzon White gave satisfactory yields if compared with Negros Purple, but in ratoon production they are inferior to the check variety.

5. Big Tanna is the poorest of all the varieties observed in sugar production, although it has bigger canes and consequently a heavy tonnage yield of cane.

ACKNOWLEDGMENT

The writers are greatly indebted to Mr. H. Gifford Stower, manager of La Carlota, for milling the Experiment Station's cane, and to Mr. Felix Jimeno, one of the chemists, for their aid with this experiment.

COMPARATIVE TEST OF THE FEEDING VALUE OF SORGHUM GRAIN AND PALAY AND CORN COMBINED AS FEEDS FOR LAYING HENS¹

The ultimate aim of poultry raising is to obtain high profit on fowls with the least cost of production. One of the most important ways to effect this is wise feeding. To give high production the chickens must be liberally fed with rations containing the materials necessary for the manufacture of eggs as well as for building and repairing muscle cells. Care and good judgment should be employed in order to raise or secure such feeds in the local market at low prices.

The common poultry feeds in this country are palay and corn, given whole, separate or combined. At their present prices per cavan, palay and corn are rather expensive feeds for chickens. Consequently it seemed advisable to find some cheaper but equally or more desirable grain.

And this experiment was made to determine the value of sorghum as a chicken feed as compared with corn and palay as regards egg production, fecundity and the growth of the laying hens.

The value of eggs largely depends on their size, appearance and flavor. The unpalatability of the Cantonese eggs from China is said to be responsible for their low price. The disagreeable taste of the egg is, it is admitted, greatly influenced by the feeds given to the chickens, therefore it is worth while to study the effect of sorghum on the color of the yolk and on the flavor of the eggs.

If sorghum proves to be just as good, if not better than palay and corn combined, as feed for laying hens, the raising of chickens both for food and eggs would be more profitable, for sorghum can be grown successfully at any season of the year and its cost per cavan is low as compared to that of either palay or corn. Consequently the home supply of chickens and fresh eggs in the market will be greater than the present supply.

¹ Contributed by the Animal Husbandry Division.

The object of the present work is to determine the feeding value of sorghum grain for chickens in connection with the gain in weight of hens and their egg production.

The experiment was begun on May 14, 1923, and lasted till April 30, 1924, at the Alabang Stock Farm, Alabang, Rizal.

Twenty Buff Orpington-Cantonese hens of about the same age, one and one-half years old, were divided into two lots of ten each. One lot was fed with sorghum grain and the other, with palay and corn combined.

Sorghum grains were given whole. Palay and corn grain, equal proportion, were fed whole.

Each hen in the two lots was weighed separately once a month. The amount of feed consumed by each lot was noted weekly, and the weights computed later, with the monthly consumption. A portable Fairbanks balance was used in the determination of the weights. At the start the total weight of the hens in each lot was about equal.

Ailing birds were separated from each group and treated in the chicken hospital. Those that recovered were put back into the same lot they came from. The records of those in the hospital are not included.

The number of eggs laid by each hen was recorded daily. The broody hens were temporarily put in bamboo crates to stop them from brooding.

The eggs were incubated artificially and the percentage of infertility and of hatch of each lot was determined separately.

In stating the color of the yolk, the technical nomenclature of color was used. The flavor test was made with both fried and boiled.

The experiment was temporarily stopped from September 15, 1923, to September 30, 1923, for lack of sorghum.

In the second set, beginning October 1, 1923, the lot formerly fed with sorghum was fed with palay and corn and vice versa, to get a balance of conditions of the two sets. This experiment was suspended again November 12 to 30, 1923.

The cost of sorghum per kilo was ₱0.05 and that of corn and palay ₱0.07 per kilo.

The results of this experiment may be seen in the following tables:

TABLE 1

Months	LOT No. I				LOT No. II			
	Palay and corn				Sorghum (Baso and Quinto)			
	Number of hens	Weight per lot	Average weight per hen	Increase or decrease	Number of hens	Weight per lot	Average weight per hen	Increase or decrease
May 15, 23.....	10	14.32	1.432	.....	10	14.2	1.420	.....
June 15, 23.....	10	15.64	1.564	.132	9	12.78	1.420	.....
July 15, 23.....	10	16.79	1.579	.015	9	12.68	1.409	.011
August 15, 23.....	10	16.64	1.664	.085	8	11.74	1.468	.059
September 15, 23.....	10	16.99	1.699	.035	8	11.92	1.490	.022
LOT No. II					LOT No. I			
October 1, 23.....	8	11.64	1.480	.....	8	13.42	1.678	.....
November 1, 23.....	7	11.94	1.708	.226	8	13.22	1.652	.026
December 1, 23.....	7	11.20	1.600	.106	7	11.72	1.672	.02
December 31, 23.....	8	11.82	1.478	.122	8	13.8	1.725	.053
January 31, 24.....	7	12.04	1.720	.242	7	11.503	1.6433	.0817
February 28, 23.....	6	8.98	1.4967	.2233	7	10.72	1.5314	.0119
March 31, 23.....	6	9.34	1.5567	.06	7	10.58	1.511	.0204
April 30, 24.....	6	9.185	1.5308	.0159	7	10.79	1.3414	.0304
Total.....				.3278				.0334

TABLE 2.—The monthly weight of feed consumed by the chickens

Months	Sorghum				Palay and corn			
	Number of chickens in a lot	Amount of feed consumed by a lot	Cost of feed in a lot	Cost of feed by a bird	Number of chickens in a lot	Amount of feed consumed by a lot	Cost of feed in a lot	Cost of feed by a bird
		Kg.	P.	P.			P.	P.
From May 15 to June 15...	10	17.0	P. 850	P. 085	11	25.5	P. 1.785	P. 162
July 15.....	10	18.4	.92	.092	11	27.1	1.897	.172
August 15.....	9	24.3	1.215	.135	11	35.0	2.450	.223
September 15.....	9	16.4	.82	.091	11	39.1	2.737	.249
October 1-31.....	9	11.5	.575	.064	8	16.4	1.148	.144
November 1-12.....	8	6.0	.30	.038	8	9.6	.672	.084
December 1-31.....	9	12.5	.625	.069	9	15.5	1.085	.121
January 1-31-24.....	8	17.0	.85	.11	8	17.0	1.190	.149
February 1-28.....	8	19.6	.980	.120	7	18.9	1.323	.189
March 1-31.....	8	13.0	.65	.08	7	23.4	1.638	.234
April 1-30.....	8	17.9	.90	.11	7	25.4	1.778	.254
Total.....		175.6		.994		252.9		1.981

TABLE 3.—*The monthly egg production of the hens*

Months	Sorghum			Corn and palay			Remarks
	Number of hens	Number of eggs laid	Average number of eggs by a hen	Number of hens	Number of eggs laid	Average number of eggs by a hen	
	LOT No. II			LOT No. I			
May 15-31.....	10	83	16.6	10	30	6.0	On December 31, one hen was returned to Lot No. I and on January 3, one hen died in the same lot.
June 15-30.....	9	47	5.2	10	62	6.2	
July 15-31.....	9	82	9.1	10	86	8.6	
August 15-31.....	8	60	7.5	10	71	7.1	
September 1-15.....	8	43	10.8	10	13	2.6	
	LOT No. I			LOT No. II			
October.....	8	27	3.4	8	17	2.1	On December 3, one hen was returned to Lot No. II and on January 14, one hen died.
November.....	7	49	7.0	7	44	6.3	
December.....	7	25	3.6	8	33	4.1	
January.....	7	45	6.4	7	46	6.6	
February.....	7	41	5.8	6	45	7.5	
March.....	7	27	3.8	6	20	3.3	
April.....	7	37	5.3	6	68	10.3	
Total.....			84.5			70.7	

TABLE 4.—*Incubation of eggs*

(a) SORGHUM

Quarters	Number of eggs set	Number of infertile eggs	Per cent of infertility	Number hatched	Per cent hatched
Second, 1923.....	45	11	24.44	32	94.12
Third, 1923.....	153	12	7.84	107	75.88
Fourth, 1923.....	72	8	11.11	53	82.81
First, 1924.....	83	12	14.45	51	71.83
Total.....			57.84		324.64
Average.....			14.45		81.16

(b) PALAY AND CORN

Second, 1923.....	25	2	8.00	20	86.96
Third, 1923.....	108	15	13.89	65	69.89
Fourth, 1923.....	60	5	7.69	53	88.33
First, 1924.....	96	20	20.83	62	81.58
Total.....			50.41		326.76
Average.....			12.60		81.69

TABLE 5.—*Color and flavor of the eggs*

Number of test	Kind of feed	Color test of egg yolk			Flavor test	
		Raw	Fried	Boiled	Boiled	Fried
First.....	Sorghum—Baso and quinto, palay and corn.	Buff yellow...	Maiz yellow....	Maiz yellow....	Normal	Normal.
		Deep chrome.	Apricat yellow..	Apricat yellow..	Normal	Normal.
Second.....	Sorghum..... Palay and corn	Buff yellow...	Maiz yellow....	Maiz yellow....	Normal	Normal.
		Deep chrome.	Apricat yellow..	Apricat yellow..	Normal	Normal.
Third.....	Sorghum..... Palay and corn.	Buff yellow...	Maiz yellow....	Maiz yellow....	Normal	Normal.
		Deep chrome.	Apricat yellow..	Apricat yellow..	Normal	Normal.

Table 1 shows that the average gain in weight of one hen on the lot fed with sorghum alone was .0334 kilo while that of one fed with palay and corn, combined, was .3278 kilo, a difference of .2944 kilo or 294.4 grams in favor of that fed with palay and corn.

Table 2 shows that the cost of the sorghum fed to one hen was ₱0.994 a year while that of the palay and corn was ₱1.98 a year, a difference of ₱0.99. Consequently, feeding laying hens with sorghum costs less than feeding them with palay and corn.

Table 3 shows that the average egg production of one hen per month fed with sorghum was seven (7) while of that fed with palay and corn was five and one-tenth (5.1), a difference of one and nine-tenth (1.9) in favor of the sorghum.

The average gain in weight of one hen fed with sorghum was .0334 kilo and the average number of eggs laid by a hen per year was 84.5 eggs. Counting ₱1 as the price of a kilo of chicken meat and ₱5 the cost of 100 eggs, the total production would then be valued at ₱4.258. And as the cost of feeding sorghum was ₱0.994 per hen, per year, the net profit with sorghum is ₱3.25. This does not include the cost of labor and other expenses.

As to the hens fed with palay and corn, the average gain in weight of one hen was .3278 kilo and the average number of eggs laid by a hen 70.7 eggs. Allowing also ₱1 for a kilo of meat and ₱5 for a hundred eggs, the total production per hen would be ₱3.86. The cost of feeding was ₱1.98. Consequently, the net profit was only ₱1.88 on palay and corn, a difference in pesos of ₱1.28 in favor of sorghum.

Table 4 shows that the percentage of infertility of the eggs laid by the hens fed with sorghum was 14.46 per cent and the percentage of hatch 81.16 per cent, while the percentage of infertility of the eggs laid by the hens fed with palay and corn was 12.6 per cent and the percentage of hatch 81.69 per cent—a negligible difference.

Table 5 shows that there was little or no difference in the effect of both feeds on the color of the yolk and the flavor of the eggs.

SUMMARY OF CONCLUSIONS

1. Chickens fed with palay and corn increase in weight more than those fed with sorghum, but give less eggs.

2. At the prices given feeding chickens with sorghum costs less than feeding with palay and corn, and the net profit is greater.

3. There is no marked difference in the percentage of infertility and of hatch between the two feeds.

4. Neither sorghum nor palay and corn discolor the yolk nor impart any disagreeable flavor to the egg.

5. Sorghum can be used profitably as food for laying hens.

6. The chickens fed with sorghum grain give more eggs per hen per month than those fed with palay and corn.

COMPARATIVE STUDY OF MILK, SHRIMPS AND EGGS AS SUPPLEMENTARY FEED FOR BABY CHICKS¹

For the protein that plays so important a part in the nutriment of fowls and in egg production there are two sources—animal and vegetable. Each has its own value but their comparative cost needs to be taken into consideration in raising poultry for profit.

Lewis(1) states that animal protein feed is better than plant protein feeds. From his experiments along this line he drew the following conclusions:

1. In comparison with the four vegetable sources of protein, the meat scrap proved to be the best egg producer, nearly doubling the next highest, the soy bean meal.

2. In the order of egg production, he gives the four sources of vegetable protein as follows: soy bean meal, gluten feed, cotton seed meal and oil meal.

3. The mortality was considerably lower in the meat scrap pen.

4. The flock receiving cotton seed meal and oil meal apparently broke down during the second year as the mortality was comparatively high.

5. The ration containing the soy bean meal was the most expensive, meat scrap second, gluten feed third, oil meal fourth, and cotton seed meal fifth.

6. A profit above feed cost was made on all pens both years with the exception of the pen receiving oil meal, which showed a loss of \$11.19 during the first year of production, but by far the greatest profits were realized from the meat scrap pen.

7. From the standpoint of the general health of the birds, the animals protein feeds were found to be the best.

Another experiment was that performed by B. Monserrat of the College of Agriculture, Los Baños, Laguna.(2) He tried copra, milk, and snails as supplementary feeds for growing chicks using corn as his basal ration. His findings are as follows:

¹ Contributed by the Animal Husbandry Division.

1. As a supplement feed with ground corn, milk is superior to either copra meal or snails for growing chicks.

2. The weekly average gain on each lot was as follows:

Milk	41.34 grams
Copra	29.28 grams
Snails	25.12 grams

3. The mortality for each lot was as follows:

Copra	33 per cent
Snails	68 per cent
Milk	38 per cent

4. The relative vigor of the chicks in each lot was:

Milk	First
Copra	Second
Snails	Third

Buss(3) commenting on the subject of feeding laying hens, "all rations for laying hens should contain a liberal amount of high protein content secured from an animal rather than from vegetable sources." Fronda(4) of the College of Agriculture, Los Baños, reported that egg production from snail-fed hens was higher than that of his copra meal-fed hens. Goseco(5) of the same college also reported that the egg production of his snail-fed ducks was higher than that of his copra meal-fed ducks.

The chicks being on the free range at our Alabang Stock Farm at Muntinlupa, Rizal are able to get some insects to balance the ration given them, and this method of acquiring animal protein is cheap and healthy provided the range is big enough. Shrimps, when plentiful in the locality and cheap, are given.

To determine the best supplementary feed, taking cost into consideration also, an experiment was begun February 2, 1924, and ended June 2, of the same year.

MATERIALS AND METHOD

Chicks of the same breed (mestizos) and age were divided into four lots, each containing about the same number.

Our ordinary feed in Alabang Stock Farm consists of the following combination:

Tiqui-tiqui	3 parts by weight
Corn meal.....	1 part by weight
Copra meal.....	2 parts by weight
Mongo meal.....	2 parts by weight
Binlid	1 part by weight

Lot No. I was fed the ordinary feed with sour milk as a supplement. In most cases, the fresh milk was used to wet the basal ration. The sour milk was fed twice a day—at nine o'clock in the morning and at about two o'clock in the afternoon. At first the young chicks did not seem to care for the sour milk given them but soon learned to like it so much that they cried for more after clearing up their ration.

Lot No. II was fed with the ordinary feed using infertile eggs from the incubator to wet the mash. This was given in the same way as the ordinary feed.

Lot No. III was fed the ordinary feed mixed with dried and ground shrimps in the proportion of one part shrimps to four parts ordinary feed.

Lot No. IV was fed with ordinary feed moistened with water. This was given four times a day, twice in the morning and twice in the afternoon. The chicks were given only enough for them to clear up the three first meals but they were given a heavy last meal. In addition to these feeds ground charcoal, fresh water and fresh-cut, tender grass were also accessible to them.

The chicks in every lot were given to trained capons. Four compartments of the brooder house were used, each being 300 centimeters long and 108 centimeters wide with a yard 600 centimeters long and 300 centimeters wide. Every compartment was provided with a box 51.5 centimeters long, 38 centimeters wide, and 25 centimeters high, where the capons and the chicks were put for the night.

The growth of the chicks and the feed consumed was determined weekly. The treatment was almost the same throughout the experiment.

TABLE 1

Breeds	Lot I	Lot II	Lot III	Lot IV	Remark
	Milk	Eggs	Shrimps	Ordinary feed	
WLBocg.....	7	5	6	7	At the age of two days, the chicks were given to trained capons.
WLBnBorp.....	3	5	5	4	
BrLBoc.....	3	3	3	2	
BrLBocg.....	2	2	3	2	
WLBoc.....	3	2	3	3	
BoBoc.....	3	4	2	3	
Bo 7 8.....	2	2	2	3	
WLeantWLBoc.....	2	2	2	2	
WLBmBn.....	2	1	1	2	
Total.....	27	26	27	28	

The results obtained are tabulated as follows:

TABLE 2.—Weekly weight of chicks and mortality

LOT NO. I—MILK

Date	Number of chicks	Weight of lot	Average weight of one chick	Increase or decrease	Weight of feed	Feed consumed	Mortality
		Grams	Grams	Grams	Kilos	Kilos	
February 6, 1924.....	27	780	28.9		10.8		
February 13, 1924.....	15	640	42.7	13.8	8.4	2.2	12
February 21, 1924.....	12	830	69.2	26.5	7.4	1.0	3
February 28, 1924.....	9	770	85.6	16.4	6.4	1.0	3
Total.....				56.7		4.2	18
Average.....				18.9		1.4	

LOT NO. II—EGG

Date	Number of chicks	Weight of lot	Average weight of one chick	Increase or decrease	Weight of feed	Feed consumed	Mortality
February 6, 1924.....	27	760	28.1		10.4		
February 13, 1924.....	16	720	45.0	16.9	9.0	1.4	11
February 21, 1924.....	10	680	68.0	23.0	7.8	1.2	6
February 28, 1924.....	9	680	75.6	7.6	6.9	.9	1
Total.....				47.5		3.5	18
Average.....				15.83		1.18	

LOT NO. III—SHRIMPS

Date	Number of chicks	Weight of lot	Average weight of one chick	Increase or decrease	Weight of feed	Feed consumed	Mortality
February 6, 1924.....	27	720	26.7		6.4		
February 13, 1924.....	10	420	42.0	15.3	5.2	1.2	17
February 21, 1924.....	10	650	65.0	23.0	4.5	.7	0
February 28, 1924.....	8	540	67.5	2.5	3.4	1.1	2
Total.....				40.8		3.0	19
Average.....				13.6		1.0	

LOT NO. IV—ORDINARY FEED

Date	Number of chicks	Weight of lot	Average weight of one chick	Increase or decrease	Weight of feed	Feed consumed	Mortality
February 6, 1924.....	27	720	26.7		10.8		
February 13, 1924.....	15	660	44.0	17.3	9.2	1.6	12
February 21, 1924.....	10	590	59.0	15.0	7.8	1.4	5
February 28, 1924.....	7	500	71.4	12.4	6.8	1.0	3
Total.....				44.7		4.0	20
Average.....				14.9		1.3	

In order to verify the preceding results, the experiment was repeated on March 20 to April 4, 1924.

The methods used were the same. The chicks used in each lot were as follows:

TABLE 3

Breeds	Lot I	Lot II	Lot III	Lot IV	Remark
	Milk	Eggs	Shrimps	Ordinary feed	
WLBocWLCant.....	1	1	1	1	At the age of five days, the chicks were given to capons.
WLCantWLBoc.....	4	4	5	4	
BrLBoc.....	3	3	3	4	
WLCant.....	1	1	2	1	
Boc.....	1	1	0	0	
WLBoc.....	1	1	0	1	
WLCant.....	2	1	2	2	
Total.....	13	12	13	13	

The results obtained were:

TABLE 4.—*Weekly weight of chicks and mortality*

LOT No. I—MILK

Date	Number of chicks	Weight of lot	Average weight of one chick	Increase or decrease	Weight of feed	Feed consumed	Mortality
		Grams	Grams	Grams	Kilos	Kilos	
March 20, 1924.....	13	480	36.9		10.2		
March 27, 1924.....	13	760	58.5	21.6	9.6	0.60	0
April 4, 1924.....	12	1,060	88.3	28.8	8.4	1.2	1
Total.....				51.4		1.80	1
Average.....				25.7		.9	

LOT No. II—EGG

March 20, 1924.....	12	400	33.3		10.4		
March 27, 1924.....	11	580	52.7	19.4	9.8	0.6	1
April 4, 1924.....	10	700	70.0	17.3	8.6	1.2	1
Total.....				36.7		1.8	2
Average.....				18.35		.9	

LOT No. III—SHRIMPS

March 20, 1924.....	13	440	33.8		9.5		
March 27, 1924.....	11	590	53.6	19.8	8.8	0.7	2
April 4, 1924.....	10	680	68.0	14.4	7.8	1.0	1
Total.....				34.2		1.7	3
Average.....				17.1		.85	

LOT No. IV—ORDINARY FEED

March 20, 1924.....	13	440	35.8		10.8		
March 27, 1924.....	11	400	40.0	6.2	10.1	0.7	3
April 4, 1924.....	7	490	70.0	30.0	9.0	1.1	3
Total.....				36.2		1.8	6
Average.....				18.1		.9	

For the third trial, some changes were made. On Lot No. I, the amount of milk consumed was also recorded.

The number of eggs consumed by Lot No. III was recorded. These eggs were boiled hard and ground fine before they were given to the chicks, as supplementary feed twice a day—at about nine o'clock in the morning and at about two in the afternoon.

Having observed that a 20 per cent shrimp mixture predisposed the chicks to diarrhea in the two consecutive trials, the mixture in the third trial was changed to 10 per cent shrimp—one part by weight of shrimps and 9 parts by weight of ordinary feed.

It should also be noted that the supply of milk and infertile eggs was variable because they were not always available.

The chicks were transferred outside to the free range in the coops May 19, 1924.

In determining the amount of feed consumed, the part that remained in the feeding trough, which was composed mainly of copra and tiqui-tiqui, was included.

The chicks used in each lot were as follows:

TABLE 5

Breeds	Lot I	Lot II	Lot III	Lot IV	Remarks
	Milk	Eggs	Shrimps	Ordinary feed	
WLBocg.	15	15	15	15	At the age of 8 days, the chicks were given to capons.
BrLBoc.	1	1	1	1	
BrLcant.	1	1	1	1	
WLeant.	1	1	1	0	
Total.	18	18	18	17	

The results obtained are shown in the following tables:

TABLE 6.—*Weekly weight of chicks and mortality*

LOT No. I—MILK

Date	Number of chicks	Weight of lot	Average weight of one chick	Increase or decrease	Weight of feed	Feed consumed	Mortality
		Grams	Grams	Grams	Kilos	Kilos	
April 28, 1924.	18	1,110	61.67	.....	11.2	.....	.....
May 5, 1924.	18	1,570	87.22	25.55	10.4	0.8	0
May 12, 1924.	18	2,000	111.11	23.89	9.4	1.0	0
May 19, 1924.	18	3,030	168.33	57.22	8.0	1.4	0
May 26, 1924.	18	3,200	177.78	9.45	6.1	1.9	0
June 2, 1924.	18	4,000	222.22	44.44	4.0	2.1	0
Total.				160.55		7.2	.....
Average.				32.11		1.44	.....

Milk consumed, 3,960 grams.

LOT No. II—EGG

April 28, 1924.	12	740	41.11	.....	11.4	.....	.....
May 5, 1924.	16	860	53.75	12.64	10.8	0.6	2
May 12, 1925.	16	1,280	80.00	26.25	10.0	0.8	0
May 19, 1924.	16	1,970	123.12	43.12	8.0	1.4	0
May 26, 1924.	16	2,140	133.85	10.73	7.0	1.6	0
June 2, 1924.	16	2,800	176.00	41.15	5.0	2.0	0
Total.				133.89		6.4	2
Average.				26.78		1.28	.....

Eggs consumed, including shell, 5,985 grams

LOT No. III—SHRIMPS

April 28, 1924.	18	720	40.00	.....	10.00	.....	.....
May 5, 1924.	16	740	41.25	1.25	9.2	0.8	2
May 12, 1924.	16	910	56.88	15.63	8.3	0.9	0
May 19, 1924.	16	1,390	86.88	30.00	6.8	1.5	0
May 26, 1924.	16	1,680	105.00	18.12	5.6	1.2	0
June 2, 1924.	16	2,200	137.50	32.50	4.2	1.4	0
Total.				97.50		5.8	2
Average.				19.50		1.16	

Shrimps consumed, 580 grams.

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TABLE 6.—*Weekly weight of chicks and mortality*—Continued

LOT No. IV—ORDINARY FEED

Date	Number of chicks	Weight of lot	Average weight of one chick	Increase or decrease	Weight of feed	Feed consumed	Mortality
		<i>Grams</i>	<i>Grams</i>	<i>Grams</i>	<i>Kilos</i>	<i>Kilos</i>	
April 28, 1924.....	17	660	38.82		11.6		
May 5, 1924.....	17	740	43.33	4.71	10.8	0.8	0
May 12, 1924.....	17	980	57.64	14.11	9.8	1.0	0
May 19, 1924.....	17	1,050	61.76	4.12	8.2	1.6	0
May 26, 1924.....	16	1,240	77.50	15.74	6.7	1.5	1
June 2, 1924.....	16	2,000	125.00	47.50	4.2	2.5	0
Total.....				86.18		7.4	
Average.....				17.23		1.48	

TABLE 2.—*Weekly mortality of chicks*

LOT No. I—MILK

Breed	Number at beginning	Number on hand at end of experiment	Mortality	Percentage of mortality
WLBocg.....	7	4	3	66.66
WLBnBorp.....	3	1	2	
BrLBoc.....	3	1	2	
BrLBocg.....	2	1	1	
WLBoc.....	3	1	2	
BoBoc.....	3	0	3	
Boc ⅓.....	2	0	2	
WLCantWLBoc.....	2	0	2	
WLBmBn.....	2	1	1	
Total.....	27	9	18	

LOT No. II—EGG

WLBocg.....	5	2	3	66.66
WLBnBorp.....	5	3	2	
BrLBoc.....	3	0	3	
BrLBocg.....	2	0	2	
WLBoc.....	2	0	2	
BoBoc.....	4	0	4	
Boc ⅓.....	2	1	1	
WLCantWLBoc.....	2	2	0	
WLBmBn.....	1	0	1	
BmBn.....	1	0	1	
Total.....	27	9	18	

LOT No. III—SHRIMPS

WLBocg.....	6	2	4	70.39
WLBnBorp.....	5	2	3	
BrLBoc.....	3	0	3	
BrLBocg.....	3	3	0	
WLBoc.....	3	0	3	
BoBoc.....	2	0	2	
Boc ⅓.....	2	0	2	
WLCantWLBoc.....	2	0	2	
WLBmBn.....	1	1	0	
Total.....	27	8	19	

LOT No. IV—ORDINARY FEED

WLBocg.....	7	1	6	74.07
WLBnBorp.....	4	1	3	
BrLBoc.....	2	2	0	
BrLBocg.....	2	1	1	
WLBoc.....	3	2	1	
BoBoc.....	3	0	3	
Boc ⅓.....	2	0	2	
WLCantWLBoc.....	2	0	2	
WLBmBn.....	2	0	2	
Total.....	27	7	20	

TABLE 4-A.—*Weekly mortality of chicks*

LOT NO. I—MILK

Breed	Number at beginning	Number on hand at end of ex- periment	Mortality	Percentage of mortality
WLBocWLeant.....	1	1	0	7.69
WLeantWLBoc.....	4	4	0	
BrLBoc.....	3	2	1	
BrLeant.....	1	1	0	
Boc.....	1	1	0	
WLBoc.....	1	1	0	
WLeant.....	2	2	0	
Total.....	13	12	1	

LOT NO. II—EGG

WLBocWLeant.....	1	1		16.66
WLeantWLBoc.....	4	3	1	
BrLBoc.....	3	3		
BrLeant.....	1	1		
BoBoc.....	1	0	1	
WLBoc.....	1	1		
WLeant.....	1	1		
Total.....	12	10	2	

LOT NO. III—SHRIMPS

WLBocWLeant.....	1	1	0	23.07
WLeantWLBoc.....	5	3	2	
BrLBoc.....	3	3	0	
BrLeant.....	2	1	1	
WLBoc.....	2	2	0	
WLeant.....				
Total.....	13	10	3	

LOT NO. IV—ORDINARY FEED

WLBocWLeant.....	1	0	1	46.15
WLeantWLBoc.....	4	1	3	
BrLBoc.....	4	3	1	
BrLeant.....	1	0	1	
WLBoc.....	1	1	0	
WLeant.....	2	2	0	
Total.....	13	7	6	

TABLE 6-A.—*Weekly mortality of chicks*

LOT NO. I—MILK

Breed	Number at beginning	Number on hand at end of ex- periment	Mortality	Percentage of mortality
WLBoc.....	15	15	0	0.00
WLBoc.....	1	1	0	
BrLeant.....	1	1	0	
WLeant.....	1	1	0	
Total.....	18	18	0	

LOT NO. II—EGG

WLBoc.....	15	13	2	11.11
BrLBoc.....	1	1	0	
BrLeant.....	1	1	0	
WLeant.....	1	1	0	
Total.....	18	16	2	

TABLE 6-A.—*Weekly mortality of chicks*—Continued

LOT NO. III—SHRIMPS

Breed	Number at beginning	Number on hand at end of experiment	Mortality	Percentage of mortality
WLBoeg.....	15	15	0	} 11. 11
BrLBoc.....	1	1	0	
BrLcant.....	1	0	1	
WLCant.....	1	0	1	
Total.....	18	16	2	

LOT NO. IV—ORDINARY FEED

WLBoeg.....	15	15	0	} 5. 88
BrLBoc.....	1	1	0	
BrLcant.....	1	0	1	
Total.....	17	16	1	

The results obtained may be summarized as follows:

TABLE VII

LOT NO. I—MILK

Trial No.	Average weekly gain in weight	Average amount of feed consumed a week by each lot	Percentage of mortality
I.....	18.90	1.40	66.66
II.....	25.70	.90	7.69
III.....	32.11	1.44	0.00
Total.....	76.71	3.74	74.35
Average.....	25.57	1.25	24.78

LOT NO. II—EGG

I.....	15.83	1.18	66.66
II.....	18.35	.90	16.66
III.....	26.78	1.28	11.11
Total.....	60.96	3.36	94.43
Average.....	20.32	1.12	31.48

LOT NO. III—SHRIMPS

I.....	13.60	1.00	70.89
II.....	17.10	.85	23.07
III.....	19.50	1.16	11.11
Total.....	50.20	3.01	104.57
Average.....	16.73	1.00	34.86

LOT NO. IV—ORDINARY FEED

I.....	14.90	1.33	74.07
II.....	18.10	.90	46.15
III.....	17.24	1.48	5.88
Total.....	50.24	3.71	126.10
Average.....	16.75	1.24	42.03

Table 7 shows that of the three sources of protein feed, milk is best as a supplementary feed for growing chicks with our ordinary ration as basal feed.

The milk lot recorded an average weekly growth of 25.57 grams per chick; the egg lot 20.32 grams per chick; the ordinary feed lot, 16.75 grams per chick; and the shrimp lot, 16.73 grams per chick. It was found that chicks steadily increased in size continuously during the first month in the brooder house and declined when they were transferred to the coops.

The weekly growth increased again when they got used to conditions on the free range. (Table 6)

Again Table 7 shows that the highest percentage of mortality occurred in the ordinary feed lot, (42.03 per cent); the shrimp lot was second, with 34.86 per cent; the egg lot, third, with 31.48 per cent while for the milk lot it was only 24.78 per cent.

The high percentage of deaths in the shrimp lot was probably due to the big percentage of shrimps mixed with the ordinary feed as 20 per cent shrimps predisposed the chicks to diarrhea. When the mixture was changed to 10 per cent shrimps and 90 per cent of ordinary feed no case of diarrhea was observed and the percentage of mortality was reduced considerably, as can be seen in Table 6, Lot No. III.

The mortality of the chicks cannot be attributed to feed alone. Management and the individual behavior of the capons and their ability to supply heat to the chicks, which is principally determined by their size, were also responsible for the low or high percentage of mortality. A high percentage of mortality was recorded when the capons were given 27 chicks each. (Table 2.) In the last two successive trials when the capons were given only 13 chicks and 18 chicks each, respectively, at the beginning the percentage of mortality was comparatively low.

It has been noticed also that the age of the chicks at the time they are given to the capons counts in their struggle for existence. When the chicks were given to the capons at the age of two days, the average weekly increase in weight per chick was low in comparison with that of the chicks given to capons at the age of five to eight days. In the case of the milk lot, the average weekly growth per chick when given to capons at the age of two days was 18.90 grams; when given at the age of five days, the weekly growth of one chick was 25.70 grams; and given at the age of 8 days, the weekly growth was 32.11 grams. The same may be said of the weekly growth of the chicks in other lots.

As to the vigor of the chicks in each lot, the milk lot came first and the egg lot second. There was no appreciable difference between the vigor of the shrimp lot and that of the ordinary feed lot.

SUMMARY

The conclusions obtained from this experiment may be summarized as follows:

1. Of the three sources of protein feed for growing chicks, milk is the best as a supplementary feed to the ordinary basal ration at the Alabang Stock Farm.

2. The average weekly growth of each chick in the milk lot was 25.57 grams; in the egg lot 20.32 grams; in the ordinary feed lot 16.75 grams; and in the shrimp lot 16.73 grams.

3. The greatest percentage of mortality was recorded for the ordinary feed lot (42.03 per cent); the shrimp lot was second, (34.86 per cent); the egg lot, third (31.48 per cent); and the milk lot, fourth (24.78 per cent).

4. As to the relative vigor of the chicks, the milk lot came first and the egg lot second. There was no appreciable difference between the shrimp lot and the ordinary feed lot.

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REVIEW OF EXPERIMENTS ON FIBER-PRODUCING PLANTS (1924)¹

ABACA

General variety test at Guinobatan abaca trial station.—Eleven varieties are being tested. Peanuts and sweet potatoes are used as cover crops, one set of the test is on level land and the other on a hillside.

Variety test on level land

	Date of planting	Number of living plants	Height		Average height of 10 plants December 15, 1924
			Minimum	Maximum	
			<i>Centimeters</i>	<i>Centimeters</i>	<i>Centimeters</i>
Item, Check	6-23-24	135	61	102	73.3
Lausigon (rootstock)	6-23-24	116	27	80	47.0
Samina	7- 9-24	126	40	112	70.5
Puti-tomatagacan	7-16-24	128	45	119	86.7
Maguindanao *	7-17-24	101	18	76	53.3
Bangulanon (rootstock)	7-17-24	125	30	93	53.8
Item, Check	7-17-24	126	38	123	85.6
Inisarog	7-24-24	138	18	100	58.1
Libutanay	8- 6-24	99	19	99	66.0
Tangongan	8- 6-24	49	14	63	34.5
Bulao	9-15-24	133	22	85	53.1
Canarajan	9-29-24	122	11	63	38.8
Item, Check	10- 1-24	142	64	150	107.9

* Suckers grown from rootstocks first set on bed.

Variety test on hillsides

Item, Check	6-28-24	100	31	135	95.9
Lausigon	6-23-24	91	25	99	49.8
Samina	7- 9-24	98	60	109	83.3
Puti-tomatagacan	7-16-24	98	39	158	111.1
Inisarog	7-24-24	88	28	98	61.7
Bangulanon	8- 9-24	78	27	71	49.5
Item, Check	9-19-24	95	76	168	116.5
Maguindanao	8-19-24	28	5	55	18.2
Bulao	9-15-24	93	14	74	50.3
Canarajan	10-29-24	73	9	100	39.4
Item, Check	10- 1-24	86	33	130	72.4

Planting tests of suckers and rootstocks.—To find out which are preferable. Variety Item used and suckers were about one meter high. Rootstocks taken from suckers about one meter high. All from one field.

Planting material	Date of planting	Total number of hills	Number of plants replanted	Height December 15, 1924		Average height of 10 plants
				Minimum	Maximum	
Suckers	6-5-24	402	52	39	128	<i>Cm.</i> 100
Rootstocks	6-5-24	392	9	38	97	71

¹ Contributed by the Plant Industry Division.

Experiments on different methods of preparing land for abaca.—Rootstocks of item planted in (a) noncleared land, (b) in cleared but not plowed land, and (c) in cleared and plowed land. Plants three meters apart and in quincunx.

Field condition	Date of planting	Total number of hills	Number of plants replanted	Height December 15, 1924		Average height of 10 plants
				Minimum	Maximum	
Noncleared.....	6-20-24	788	80	19	139	Cm. 68.0
Cleared and nonplowed.....	6-17-24	476	21	38	111	55.3
Cleared and plowed.....	6-23-24	816	11	45	110	76.4

AGAVES

Distance of planting tests with sisal and maguey at Lamao.—This experiment was started last year. Both the sisal and maguey plants are doing well. The plots occupied by these plants have been kept free of weeds.

Variety tests of agaves and sansevieras at Lamao.—These tests are being continued. The plants are still too young for stripping or retting. In December 1924, the maguey, sisal, Agave Sp. (unidentified), Sansevieria sulcata and S. Zeylanica were already suckering but the Henequen and Hagave Zapupe were not. With the addition of 1,572 sq. m. the area now occupied by this culture is 5,226 sq. m.

COTTON

Acclimatization tests of cotton at Lamao.—The varieties in these tests were not planted at the proper seasons and this accounts in large measure for the smallness of the yields. These tests will be carried on for three more years at least, however.

Partial results of the 1923-24 tests are reported hereunder:

Variety name	Yield of bolls per hectare	Remarks
	<i>Kilos</i>	
New Baykin.....	66.35	Suffered very much from rain and flood.
Ferguson.....	297.82	Do.
Lone Star.....	64.77	Do.
Cambodia.....	103.76	Do.
Kinastila.....	831.96	Do.
Caravonica.....		Bolls still immature.
Toquillo.....	32.15	All plants in the fourth row died.
Trico.....	110.80	All plants in the third and fourth rows died. Suffered very much from rain and flood.
Cuban, Brown.....		Bolls still immature.

Distance of planting experiments with cotton at Lamao.—The results obtained from the 1923 culture are shown hereunder.

Cotton varieties	Distances			
	1 m. × 1 m. Yield of bolls per hectare	1 m. × 90 cm. Yield of bolls per hectare	1 m. × 80 cm. Yield of bolls per hectare	1 m. × 70 cm. Yield of bolls per hectare
	Kilos	Kilos	Kilos	Kilos
Sea Island.....	21.93	21.57	32.38	26.90
New Baykin.....	49.48	60.67	56.10	99.14
Ferguson.....	653.12	136.50	110.17	291.88
Lone Star.....	52.23	35.90	95.43	75.52
Cambodia.....	210.40	53.59	82.35	68.71
Kinastila.....	479.59	609.54	439.52	999.26
Caravonica.....	(a)	(a)	(a)	(a)
Toquillo.....	34.02	41.88	52.69	(b)
Trice.....	85.71	357.88	(b)	(a)
Cuban, Brown.....	(a)	(a)	(a)	(b)
White, Ilocos Norte.....	(b)	(b)	(a)	(b)
White, Tagudin.....	(a)	(a)	(a)	(b)
White, Bangar.....	(b)	(b)	(c)	(b)
Wagwag (perennial).....	(b)	(b)	(b)	(b)

^a Bolls immature.^b Plants died.^c Bolls died.

This experiment is being continued at present.

Seasonal planting of cotton at Lamao.—The results of this experiment are only partial as the plantings made from September up to December (1924) were not yet harvested at the time of writing this report.

The plantings made in January, February, and March had a uniform stand and vigorous growth.

The varieties planted in January, 1924, flowered during the first days of May, 1924, and those in February and March, 1924, flowered during the first part of September, 1924. The plants had a uniform stand and made a vigorous growth, but no crops were obtained as the bolls were destroyed by insects and rain. Of the April planting only one plant survived. Those planted in May died on account of the continuous rains while the plants were still young. No plantings were made in June, July, and August due to continuous heavy rains. The plantings made in September and October are showing promising results. The plants are now in bloom. The plantings made in November and December are coming on well also.

Depth of planting test with cotton at Lamao.—Seeds of Sea Island cotton were planted at different depths ranging from one centimeter to eleven centimeters on February 20, 1924.

Depth of planting in centimeters	Date of planting	Date of germination	Per cent of germination
1.....	February 20, 1924	February 25, 1924	83.33
2.....	do.	do.	100.00
3.....	do.	February 26, 1924	66.67
4.....	do.	do.	33.33
5.....	do.	February 27, 1924	33.33
6.....	do.	February 29, 1924	16.67
7.....	do.	do.	0.00
8.....	do.	do.	0.00
9.....	do.	do.	0.00
10.....	do.	do.	0.00
11.....	do.	do.	0.00

From this table it is evident that cotton seeds should be planted at a depth of two centimeters to obtain the maximum percentage of germination.

Longevity tests of cotton seeds at Lamao.—These will be continued as the results previously obtained are not yet conclusive. Preliminary tests, however, indicate that cotton seeds may be kept in dry sawdust and dry moss for all months and still give as high as 20.4 per cent germination.

Breeding experiments with cotton at Lamao.—The procedure was to bag a flower before the opening of a plant of a known variety, then pollinate it with pollen from another plant of the same variety and then bag the flower again. The resulting bolls are still immature at this writing. The varieties used are the Cuban Brown, Sea Island, New Baykin, Cambodia, Lone Star, Kinastila, Caravonica, Toquillo, Trico, and Ferguson.

KAPOK (*Coiba pentandra* Gaertn)

Planting experiments with kapok from cuttings at Lamao.—This experiment was started on September 2, 1924. The sizes of cutting and percentage that sprouted are given in the following table:

Kapok cuttings		Dates of—		Per cent of sprouted cuttings
Lengths in feet	Diameter at butt in inches	Planting	Sprouting	
1.0.....	0.5	September 2, 1924	September 7, 1924	60
2.0.....	1.0	do.....	do.....	15
2.5.....	1.5	do.....	do.....	45
3.5.....	2.0	do.....	do.....	45
4.5.....	2.5	do.....	do.....	70
6.0.....	3.5	do.....	do.....	100
8.0.....	4.5	September 3, 1924	September 12, 1924	100
10.0.....	5.0	do.....	do.....	100

The results show that big cuttings have a better chance to grow than small cuttings. The small cuttings sprouted 5 days earlier than the big cuttings. The rooted cuttings with diameters ranging from 2.5 inches to 5.0 inches were transplanted to the permanent field on November 19–20, 1924, for further data. The other cuttings died during the latter part of that month as a result of the continuous dry weather.

From this test it may also be concluded that cuttings should be planted directly in their permanent places.

Distance of planting tests with kapok at Lamao.—This experiment was started in 1923 to find out the proper spacing for kapok. The trees are now growing fast, some of them having reached a height of 3 meters. Care is taken to control the weeds.

ROSELLE (*Hibiscus Sabdariffa* var. *Altissima*)

Retting test with roselle at Lamao.—The white and the red roselle of the altissima variety are propagated at Lamao Station for both seeds and fiber. The seeds were harvested in about five months and the white roselle (210 square meters) yielded 20.22 kilos of seeds while the red roselle (168 sq. m.) gave 12.20 kilos.

Roselle stalks retted in stagnant and muddy water are ready to be washed to separate the fiber after 12 days, while those retted under running water cannot be washed until after 14 or 15 days. The red roselle, with stalks 1.9 meters long and 4.95 centimeters in circumference, gave 22 grams of cleaned fiber per stalk, while the white roselle, 1.9 meters long and 4.62 centimeters in circumference, gave 20 grams of clean fiber per stalk, last season.

Seasonal planting test of roselle at Lamao.—This experiment seems to prove the assertion that the right time to plant roselle is during the months of May and June to obtain the maximum yield. This experiment will be repeated four times.

Month of planting	Condition of plants
January.....	Too dry—no planting was made.
February.....	Do.
March.....	Do.
April.....	Do.
May.....	Tall, vigorous, productive.
June.....	Do.
July.....	Failed to germinate due to continuous rain.
August.....	No planting—soil too wet.
September.....	Uniform stand of plants, but too small 20 to 50 centimeters high, produced flowers in 20 days.
October.....	Do.
November.....	Do.
December.....	Do.

MISCELLANEOUS FIBER PLANTS

Jute fiber yield test at Lamao.—From 100 stalks (120 centimeters long) retted in running water and washed after 12 days, 300 grams of clean fiber were obtained.

Depth of planting test with jute seeds at Lamao.—Seeds were planted in germination box at depths ranging from 1 centimeter down to 11 centimeters. The “1-centimeter deep” and the “2-centimeter deep” plantings gave the highest germination.

Seasonal planting test of jute at Lamao.—Monthly plantings of jute seed, from January to December, 1924, inclusive, were made at Lamao Experiment Station. The plantings made during the months of February and March gave the best results: the plants reached the maximum height of from 270 to 305 centi-

meters, and on May 23 and September 29, 1924, abundant harvests of seeds were gathered.

Acclimatization tests of miscellaneous fiber plants at Lamao.—Several plant immigrants are being acclimatized at the Lamao Experiment Station.

The (so-called) wild pineapple.—Several plants of this variety, which were found in a corner of the old nursery near the bamboo clumps at Lamao Experiment Station, and which are supposed to have been introduced years ago, were set out in a new field for future fiber tests.

Pita floja (Ananas macrodentes).—Twelve plants sent by Mr. Helger Johnson, agronomist, from his "Plant Introduction Garden," Summit, Canal Zone, were received at this Bureau on November 5, 1924. These were sent to Lamao Experiment Station on November 6 for trial planting purposes. The British scientists claim this produces the strongest fiber known and that it is being exploited under the name of "Arghan" by a stock company in London.

Another notable plant immigrant was the *Yucca (Yucca elata)* from Dr. J. J. Thornber, dean of the University of Arizona, Tucson, Arizona. Four ounces of seeds and four rooted cuttings were sent to Lamao Experiment Station on November 29, 1924, for trial planting purposes.

Gossypium anomalum (S. P. I. No. 55410).—Fifty-six seeds were received by this Bureau from Mr. Peter Bisset, plant introducer of the Bureau of Plant Industry, United States Department of Agriculture, on May 27, 1924, and were sent to Lamao Experiment Station on May 28, 1924.

Twelve varieties of cotton which are shown in the table below have been reintroduced in Lamao from various sources.

Variety	Quantity	Source
Durango.....	.08 gram.....	La Carlota Experiment Station.
Quiote.....	$\frac{1}{2}$ gram.....	Paoay, Ilocos Norte, March 18, 1924.
Wagwag.....	1 liter.....	Dasol, Pangasinan, April 2, 1924.
Lu-nes.....	$\frac{1}{2}$ liter.....	Burgos, Pangasinan, April 2, 1924.
Mestiza.....	2 grams.....	Batac, Ilocos Norte.
White.....	1 gram.....	Lapog, Ilocos Sur, March 20, 1924.
White.....	3 liters.....	Tagudin, Ilocos Sur, March 25, 1924.
White.....	2 grams.....	Bangar, La Union.
White perennial.....	1 gram.....	Paoay, Ilocos Norte.
White.....	$\frac{1}{2}$ gram.....	Do.
Carvonica.....	15 seeds.....	Herbert J. Rumsey, Australia.
Khaki.....	.004 gram.....	Ronda, Cebu, August 16, 1924.

The seeds had a very poor germination. But there are a few living plants of the white varieties from Ilocos Norte, Ilocos Sur, and La Union. All the other resulting plants died.

Kapok "Haden" (Ceiba pentandra Gaerta).—One kilo of "Haden" seed was sent to the Lamao Experiment Station on February 7, 1924; the material came from Buitenzorg, Java. The seed was sown in the seedbed on August 21, 1924. The germination was about 30 per cent. The seedlings will be transplanted in the field next rainy season.

The Balsa (*Ochroma Lagopus Bombacaceae*) is the so-called West Indian cork wood and is the only species known. A few seeds were sent to Lamao Experiment Station on July 17, 1924, the material having been received from the Department of Agriculture and Labor, San Juan, Porto Rico. This is said to be a handsome tree of rapid growth and a wood lighter than cork. Useful for making bancas, etc. It is also quite possible that the fiber surrounding the seed may be found useful like kapok and that one pod of balsa has at least two or three times as much fiber as a pod of kapok.

Pocheto (Ceiba aescalifolia).—Thirty-seven seeds were received from Mr. H. T. Edwards of the United States Department of Agriculture on September 23, 1924. The fiber of this plant is said to be similar to kapok. The seeds are being propagated in the acclimatization plot.

THE RESULTS OF THE ECONOMIC DEVELOPMENT OF THE PHILIPPINES

By TRINIDAD PARDO DE TAVERA

The conquest of our Archipelago was not inspired in the mind of the king of Spain by economic ends: at least, it was not this reason that was ever invoked, but that of converting its inhabitants to the Roman Catholic Apostolic faith. It was, therefore, a colonization of a religious character and, while Europeans came to neighboring regions to extend and impose their trade, Spain came to the Philippines to impose its religion, bringing missionaries instead of merchants, organizing religious development, interesting us more in the problem of the salvation of our souls than in the solution of the problem of our existence on earth, in a word, educating us in its civilization of a military and religious character.

When we examine both the laws that govern us and the work of the first governors and the discussions, disputes, and differences among the representatives of the new sovereignty in the Philippines, we see that all had a stamp, and end, and an activity of a religious character. The entrance of Chinese into Manila and their residence therein was permitted for the purpose of converting them, subsequently their expulsion was advised under the pretext that only a very few were converted and that they perverted the Filipinos by their example; war was carried into the south because the Moros persisted obstinately in their religion and it was necessary to baptize them against their will so long as it could not be done with their consent; for the same reason Protestant foreigners were excluded and, finally, when in 1620 the king of Spain wished to get rid of the colony it was only an expense to him, one of the missionaries of the Philippines, Father Moraga, reminded him that the purposes of the kings who ordered the conquest were not of a material character but purely and exclusively religious, so that the king, returning to less interested sentiments, resolved to keep the Philippines under his dominion in spite of costing him money.

Heretofore no criterion has been adopted to distinguish the periods in the history of the Philippines: only the so-called period of discovery and conquest appears to be as justified as

it is clear. After that our history is a chronicle of the governors that have followed one another, and beyond this classification by governors, there is no other based on any general and lasting phenomenon which may have characterized a more or less extensive age. After the first period, rightly called of discovery and conquest, I conceive three periods are really such and which are: That of Tutelar Sequestration; of Commercial Liberty; and of National Upbuilding.

When I shall have reached the end of my lecture I shall have had an opportunity of demonstrating to you the reasons I have for establishing these periods. For the present, on enunciating them, I reveal to you the way which I look upon and explain to myself the causes determining the entire evolution of our society from the type which it presented at the time of the arrival of the Spaniards to the present moment. In this way, you will see that parts have been played by the restriction or by the development of economic combinations and I will be able to show to you the influence of material welfare on the progress of our people.

At the time of the arrival of the Spaniards, the economic condition of the Filipinos was in the primitive period as may be readily understood: the petty chiefs and their headmen lived off the work of their subjects who produced rice, were engaged in fishing, gather the natural fruits and products of the forest, looked after domestic animals for the support of the community, and likewise devoted themselves to the case. Their industries consisted in the weaving of textiles for clothing, manufacture of pottery for household uses, and of hats, mats, and all other articles, in a word, necessary for clothing themselves and supplying other urgent needs, amongst them warlike arms and implements for hunting, fishing, and agriculture. Agricultural and industrial products were of course few in number, of purely domestic make and in quantity just sufficient to supply the demand for consumption in the tribe.

Naturally the arrival of the Spaniards produced a lack of equilibrium between the supply and demand, the latter being out of all proportion greater than the former. We can imagine the crisis at that time, by what now happens in the country and even in some unimportant towns in the provinces, on the arrival of a stranger who is not content with the most common products for his food and who seeks chicken, eggs, fish, fruits in season, and who at once exhausts the entire stock. If, instead of one or two strangers, more arrive, then the crisis comes sooner and

in an instant there is a dearth of the articles used for local consumption.

Legaspi established the capital of his government at Cebu, but in a short time, as the Spaniards were lacking the articles necessary for their subsistence, they decided to transfer their residence to Panay, where, apparently, such articles were more abundant. But not much time was spent in Panay without the Spaniards feeling the want of supplies; Legaspi and his captains were constantly imploying the king to send them food: they were dying of hunger. Father Rada feared that everything would be destroyed in a short time by the soldiers, as the means they adopted to get food was "to rob the natives and burn their villages and make slaves of them claiming that they could not subsist themselves without so doing." According to this missionary, the religious who had come at the command of H. M. "had not been provided with more than a little rice each week for their food."

Juan Maldonado wrote the king that "Legaspi having heard that the island of Luzon was large, well stocked and with many people and a great trade, and in view of the island of Panay being poor and much want was felt there he sent the Maestre de Campo with enough people to see the land of Luzon, etc., etc."

When Martin de Goiti made his blood pact, before the taking of Manila, it was capitulated that "the Moros of Manila would subsist the Spaniards who came to settle there and giving this tribute they would give no other."

Letters from the governors as well as those from religious and laymen, and the records of that time are a continuous repetition of the deplorable scarcity of food as much as amongst the people as amongst the privileged class. He who is poorly nourished cannot even think of providing for other less urgent needs of life, and when the most elementary necessities have not been satisfied it is absurd to suppose that man aspires to fill wants of a higher order though less necessary for life, so that there is no progress nor civilization possible for the man who is in such condition.

The reward in the life to come which religion held out to the man most resigned to his fate, who had suffered most from hunger, humiliation, persecution, exploitation, injustice, despoilment, privation, vexation, misery, and pain, could not, we contend, serve to encourage anyone to seek the means of leading a different life, but rather served to make him thank providence for having placed him in a condition to enviable for

winning, in exchange for a fleeting existence of life on earth, the supreme happiness of an eternity free from anxiety. I do not, to be sure in making this consideration, attempt to blame religion: I simply mention it to show that this condition of the poor did not present a religious but an economic problem, which could not be solved by a reward in a future life as compensation for barren suffering on this earth, but could only be solved by the performance of the duty to labor resulting in a reward in this life from the enjoyment of the right to share whatever benefit might come from the performance of such duty.

Let it not be thought from what has been said that the economic question did not take up the attention of the king nor of his representatives in our country: they wished at least material development, but the fact is that the means of getting it were not understood. The only means of providing themselves with subsistence and of acquiring wealth in the society of those days, suitable to the character of the military and religious civilization, were of a predatory nature, the same, at the bottom, as those employed by the Filipino chieftains before the arrival of the Spaniards. These methods consisted of slavery, the contributions that under the name of tribute were given by the Filipinos either in money or in articles of food or dress, personal service rendered under the law for works of a public character, but extensively and abusively employed for private profit, as the new arrivals neither, would, could, nor knew how to devote their energies to reproductive work in agriculture or industry, seeing what their ideas were on the subject nor did any one come over who was not a soldier, a missionary or government official. In a royal mandate of the 26th of May, 1609, the king said: “. . . it is known the many Spanish people there are in those parts both from the number of those who leave here usually and of the number of creoles born there and it is also understood that although there are many of these people that do be humble and poor they are inclined to work in the labors of the field, mines or other profitable occupations or serve other Spaniards and they do hold it humiliating; from which it comes there be so great a number of vagrant and idle persons and the placing upon the Indians of the entire weight of the work and service of the Spaniards . . .”

The *encomenderos* lived off the tribute received from their *encomendados* either in money or in kind, in addition to the tribute Filipinos were obliged to work, as we have said, 40 days each year on public works, but every *alcalde*, every *encomen-*

dero, and every official of any kind who could do so applied such services to his benefit, making the Filipinos work around his house or lands in every way and by every means.

The causes which develop economic conditions were in this manner restricted. There was, however, some progress under these conditions although it was in the very meager proportions permitted by such restriction; as buildings were erected, roads were built, improvements were made which remained in the country and the desire was awakened to imitate the privileged classes in order to obtain the same benefits that they were seen to enjoy. In this way the number of exploiters of the people was increased, material betterment naturally improving but slowly. This method was not the proper one to stimulate work which did not benefit the worker: on the contrary, it became constantly more odious to him as it brought him only hardship, ill-treatment, increased the hunger and more discouragement the more he worked. That awoke the desire to imitate those who enjoyed, imitation extending the eagerness to follow, like predatory methods.

That small material development was slow, odious, unjust, sterile. It was slow, because it was the product of coöperation resulting from coercion; it was odious, because it exploited the weak; it was unjust, because some performed the duties and other availed themselves of the advantages; it was sterile, because it did not develop sentiments of a superior but of an inferior order such as deception, humiliation, passivity, discouragement and fatalism.

In the meantime colleges and universities were founded in Manila where grammatical, philosophical, theological, and juridical studies were made for the purpose of forming a directive class incapable of giving the people good direction, at least good economic direction. Such an education served the purposes of fortifying the existing social type, making it more and more persistent in its error, principally in the contempt for manual labor and of all that give life to economic phenomena which if held in contempt by them were nevertheless exploited at their pleasure. It was an idea of the time that some men had been born to exploit and others to be exploited and as those who so thought and believed were none other than the exploiters, they resigned themselves in a Christian manner to their fate in order to set an example of resignation to the power exploited whose credit account was to be balanced in the next world.

Let us not seek the causes of the development of civilization in artificial but in natural phenomena. At times we find an artificial fact which we take for a determining cause, but if we stop an instant to consider if it is the effect of other causes and so follow our retrospective analysis, we at length discover a phenomenon of a natural character to which we can attribute the part of first cause of all the other results that we have passed in review. Follow this method and you will see that political, religious, artistic, moral combinations all spring from the most essential phenomena of our own existence which pertain to nutrition. PRIMUM VIVERE.

The mentality of hunger.—Hunger and the necessity of providing for nutrition was during the first period of our history the most serious and constant preoccupation; it was also so during the second period, and this need transformed into a permanent idea has come down to our own days explaining why we do not find an explanation more generally accepted amongst us, than that of calling a man who seeks office of hungry “basabasero” and by like terms by virtue of a mentality of hunger and want; it never occurring to us that the desire to hold an honorable position, the attraction of power, and the luster of office might be comprehensible reason: to a hungry society, hunger is the general and principal motive. On this same subject the distinguished Spanish sociologist, Rafael Salillas, rightly says: “Quevedo, in *El Gran Tacaño*, reproduces poverty; and in this sort of literary sincerities there is no literature which abounds in episodes growing out of the scarcity of food to the extent that ours does.” Even now we have yet to solve the problem of the material conditions relating to the feeding of the mass of our population and we can understand its condition at that far off time by reflecting on its present condition. After all, it is but the result of social constitution organized as we have said for the benefit of a privileged class which limited its own progress with the restriction that, in its selfishness, it imposed upon the majority.

The new sovereignty brought to the colony along with its economic order its own methods for the acquisition of wealth; it established its system of finance and its literary education; military, civil and religious functionaries believed in the efficacy of laws for the modification of customs, and Peninsular Spaniards of the lower class aspired only to secure offices or privileges which would permit them to live off the work of the

natives, having neither preparation, enterprise nor the wish to engage in agriculture, and at most were only fit for trade.

Limitations of trade.—For this reason the economic phenomenon which appeared in those days was poor and limited, as we shall see.

In imposing a tax payable in articles of food and dress, the foundations of the Philippine industry were unwillingly laid. It is natural for a person manufacturing a piece of cloth for the purpose of paying tribute with it to have an interest in making another like piece to sell or exchange for some other needed object. At the same time, as the *encomenderos* and *alcaldes mayores* engaged in trade sold the articles received as tribute, a market for industrial products was in this wise created which provoked a demand for such merchandise.

I have called this epoch of our history the age of TUTELAR SEQUESTRATION, as the most characteristic thing in it was the insistence in prohibiting the colony any contact with foreign countries excepting China, Japan, and neighboring Asiatic kingdoms, and then only under limitations that really reduced the Philippines to isolation. Not the slightest contact would be had with the countries of Europe and in order to avoid an extensive enumeration of the countries with which we were not permitted to trade, I will say that we could only trade with Acapulco in the vicekingdom of New Spain or Mexico. Nor was this exclusive trade unrestricted; we were unable to clear more than one ship loaded with merchandise each year which afterward returned bringing us the money value of the merchandise shipped, which at first could not exceed the sum of \$500,000, afterwards increased to \$1,000,000.

The commerce of old.—To load the Acapulco vessel, its capacity was divided into a certain number of parts represented by certificates called *boletas* each of which represented a package of merchandise containing on the average articles valued at about \$125. Such certificates could be used by certain persons only, so that this poor trade was also monopolized by a few. The greater part of the articles shipped on the *nao* consisted of silks, porcelain, tiles, and other Chinese manufactures, tropical spices and other products from the Moluccas, Borneo, the Coromandel coast and some native products such as lumber, dyewood, shells, mother pearl, etc.

As we had no merchant marine, our commerce with the Asiatic nations was limited to products brought thence in their vessels,

which took in return principally our silver coined money received from Mexico and some wild products of our woods and seas.

Repeated royal orders reminded the governor of the absolute prohibition of the entrance of foreigners, or brought sharp reprimands for the occasional infraction of the inflexible law by permitting a foreigner to remain in Manila for more than a few days when, through accidental or uncontrollable causes, some vessel had sought refuge or was brought by adverse winds to the then inhospitable bay of Manila.

Absolute sequestration.—What sort of economic development could be hoped for under that kind of absolute sequestration? The freedom of production and exchange is the foundation of all economic development, and under such adverse conditions as those which prevailed in the Philippines, nothing could be hoped for but the condition of poverty and misery which prevailed.

Even the Spaniards themselves were prohibited from residing in Filipino towns, where they could stay out more than three days.

For whose benefit were the principles and ideas of European civilization brought by the Spaniards? For the benefit of an exceedingly small part of the Filipino people, the part made up of the individuals whose material condition had been improved, who had made some economic progress.

The object of the restriction was to favor the industries and commerce of Spain, so that after all if the king did not effect the conquest for mercantile purposes, he maintained the colony under a tutelar sequestration to favor the economic industries of Spain and at the same time to safeguard the religious interests of the Filipinos piously placed beyond possible contact with heretics, protestants, and persons dangerous to the new converts.

The slave.—The most infamous and least enviable condition at that time was without doubt: that of the slave. The Spanish laws abolished slavery, but before they were abolished freedom from slavery could be purchased by ransom, a payment of a sum determined by custom being made to the slave owner. Thus, the most useful effect which certain economic development brought to the slave was that it gave him the means of ransoming himself: his economic condition therefore served to procure him his liberty. The liberating effect of individual economic progress is the cause of moral and intellectual advancements, as we shall see throughout the entire course of our lecture.

Europeans were obliged to avail themselves of the most prominent natives in their commercial and other dealings with the mass of the people. As we have seen, they were the very persons who possessed some property. At first it was the old principles who played the part of intermediaries, but the newcomers finally surrounded themselves with the most intelligent and the most capable men, these qualifications increasing the usefulness of a man. They won for themselves, by being close to the Spaniards, a more flourishing economic condition, improved their material condition and ended by attaining to independent positions, the wealthiest amongst them forming the privileged class, and consequently the leading class in the community.

Some development.—The progress made by the Filipinos during the period of their history was not the result of education but of material development. Education was given only in Manila at some colleges which were then set apart for the children of Spaniards. Outside of the capital all education consisted of the teaching of the Christian doctrine. We have seen that such Christian education was in the Philippines, as in all parts of the world, the true consolation and refuge of afflicted souls, of the destitute, of the humble and of the poor. The mass of the Filipino people found in the new religion the same alleviation of the tribulations of their simple souls, but nothing which might serve to encourage their material development.

We have already said that resignation is a negative condition, that it is greater the more humble and poorer the individual; he who has his living assured and lives in the midst of certain welfare, is also, for this reason, the less disposed to put up with humiliation the better his material position. In the same way the aspirations, ambitions, desires, and necessity of securing the boons of individual independence and social position as well as the sentiment of personal worth are sentiments and necessities of a moral and intellectual order which result directly and necessarily from material welfare. It is true that once such intellectual and moral sentiment are acquired they remain in our soul, though the cause of them vanishes after their acquirement, that is to say, though we lose our material welfare; but it is no less true that this was the cause of the appearance of such sentiments in our consciousness.

New desires appear.—It is easy to see that the material progress of man is the cause of this moral and intellectual advancement, as the conquest of material welfare are naturally followed

by the appearance of desires, ambitions, and necessities of an intellectual and moral order.

Later, I shall again mention these relations of cause and effect; now I wish it to be noted that owing to the progress in material things of that first period, the Filipinos made advancement of a moral and intellectual order, that were not greater not only on account of the existence of causes preventing it, but because others more efficacious and natural, based on material progress itself, suffered a tremendous and almost invincible restriction.

As all evolution is gradual, for however rapid the phenomena changes are never instantaneous and consequently, between one extreme, representing the primary phase, and the other representing another and the latest totally different phase and without apparent relation to the first we find phases gradually distinguishing themselves from one another in a continuous chain leading from one extreme to the other. To characterize the periods of our history I have taken some of the characteristic features which from time to time and separated from one another clearly appear as prominent phenomena: these I have deemed worthy of giving their character to the three periods mentioned.

It appears that at the end of the first period, phenomena began to appear which were related with those of the following one, and at the beginning of the latter we find characteristics of the last period which little by little became gradually dissipated until but vestiges of them remained.

Commercial liberty.—The period of COMMERCIAL LIBERTY I start with 1614 on account of the treaty with England by which Spain opened to foreign commerce certain ports of its colonies and authorized the residence therein of foreigners under certain restrictions. The initial phenomena of this period began to be noted in 1733 when tutelar sequestration was somewhat relaxed, although only theoretically, by the establishment at Madrid of the *Compañía de Filipinas* which was allowed trading privileges with our Archipelago. I have said theoretically because the company never began operations. Later we shall again deal with this institution.

Not much could be hoped from the efforts of the people to secure more than material welfare, for in order to give birth to aspiration of a moral and intellectual order it was necessary to create a foundation, a determining cause for such aspiration, and that could be no other than economic independence of the individual. His material betterment in the midst of the conditions by which he was surrounded had to be the result not so

much of his manual work, as of other inferior conditions such as economy, the exploitation of the more ignorant usury, propitiatory acts to the men higher up, in order that spoliation might be more safe and certain for the man below, and the acquisition of political positions to assure his freedom in the despoilment of the producers.

Philippine exploiters.—Of course when I mention exploiters I do not refer only to members of the ruling class but mean to include with them Filipinos and Chinese engaged in amassing wealth and who lived by methods known as the methods of exploitation which we have repeatedly mentioned; the persons exploited too were Filipinos in the majority of cases with a few individuals of the ruling race, for such were the wretchedly paid soldiers who being exploited in this manner had in turn to become exploiters in order to be able to nourish themselves and live.

Man has no other recourse to free himself from man's exploitation than his own efforts through which, by work, he does not allow himself to be cheated nor controlled by another. From his capacity enabling him to direct his energy to produce and his intelligence to avoid being cheated, man wins liberty; by no other means can he acquire his real freedom.

The encomenderos.—The Filipinos were able to free themselves from the institution of the *encomenderos* by the intervention of the missionaries who in their own struggle to live sought aid from the Filipinos themselves, amongst whom they naturally selected the leading men, that is to say, those men whose economic condition was good. With the advent of the *alcaldes mayores*, who at the same time that they were the governors and the judges had also the monopoly of the trade of their provinces, the abuses of the *encomenderos* were somewhat diminished; the *alcaldes mayores* represented the hypertrophy of political, judicial and economic abuses: the great attraction of the office consisted, however, exclusively in the possibility of being able to manipulate unchecked combinations of an economic character. Once more the missionaries faced the *alcaldes mayores*: their motives, according to their own statement, were purely altruistic, to do good for its own sake, without any personal considerations: in the opinion of others, they were also actuated by economic purposes in order to become the only exploiters. There is no need for us to explain, but only to record, this event of the political life of the colony; to mention that the missionaries had to associate in their work those

Filipinos of the *principalia*, who by this fact, were their allies and that in asking for their help they gave their own. The *alcaldes mayores* were not without the help of certain headmen, who, on account of economic interests, were a sort of associates in their undertakings of exploration, so that the *principales* in dividing, some placing themselves at the side of the missionary, others at the side of the *alcalde mayor*, all moved by the same impulse of improving, keeping or earning material benefits, had formed two great parties guided by the same economic motive. We shall see how the only thing that could wrest the Filipinos from the tutelage of *alcaldes* and priests was commercial freedom that, in destroying monopolies, tutelages and commercial subjections and restrictions, placed the Filipinos in a condition to escape legal exploitation and of afterward continuing insensibly and automatically along the paths that over the great road of commercial freedom led to intellectual and moral liberty.

A transitory power.—Without any doubt, in considering a power of political, military or religious character it appears that it is the most important and the most difficult to overcome, but its character is purely transitory, while power derived from conditions, purely personal, determined by economic conditions, is more lasting and firm. On the other hand there is no lasting political nor military power if it does not rest on good economic conditions.

The higher exploiters had the wealth, and as they increased in number, the number of the lower exploiters, who felt the growing intolerance of the subjection and exploitation of those above them, increased accordingly. Their feelings of protest were symptoms of the appearance of feelings of a moral and intellectual order.

Change in Catholicism.—If the Catholicism practised and preached by the first missionaries during the period of sequestration was rather of an ascetic character, we see a change in it as soon as it adopts from more conciliatory to earthly exigencies, as when the missionaries were converted into parish priests. The missionaries lived poorly, almost wretchedly, without an adequate dwelling or churches, on account of wanting money to such an extent that they lived on the aims given by the king who furnished them with a little rice, wine for the mass, and even a little oil for the lights used in worship. As soon as the Filipinos of the lowlands were converted and their means permitted them to attend to the needs of the Church the material situation of the missionary began to improve. On the other

hand, the Friars understood the urgent need of assuring their welfare and began to take heed of the economic improvement of their institutions, as well as of the missions, then converted into curacies, and of the condition of their parishioners.

Toward the end of this first period the missionaries had themselves become landowners, who cultivated their lands by leasing them to tenants. Already the Filipinos saw the use of riches in terrestrial life, and their enormous influence for welfare in future life. Without money the solid temples for the adoration of God could not be built, nor could the beautiful festivals be celebrated in them in honor of their holy patrons. Nor could the silver altars be erected, images which adorned the temple be carved, nor the sacerdotal vestments be embroidered nor offerings be made of the costliest apparel, jewels set with precious stones lighted wax candles, or the costly bells be hung in the church towers, nor costly legacies be made, nor alms distributed for the redemption of the soul of the donor or of the souls of his relatives who suffer in purgatory, prayers be said, bulls of pardon be bought, masses be ordered, indulgences be got, nor could they avail themselves, in short, of all the means so generously offered by a religion that presents to us a whole series of propitiatory means of securing the pardon of sins and the favor of the divinity placated thereby.

It is for this reason, (the material splendor of the church) no doubt, that we see these pious persons possessing goods of this world who do not make use of them to improve their material existence, who live no better than the poor, dress simply, have no comforts in their homes and have only those things that are strictly necessary, but who save their money to squander it unstintingly on splendid *novenas* of which they are the *hermano mayor* or *hermana mayor*, as the case may be; who found chaplaincies, order masses said, and have themselves buried with magnificent funeral ceremonies in which the music of organ, orchestra, and of choir singers serves for the repose of the soul of the departed and for the consolation of the survivors.

Brute and brute.—The influential people of that time called the natives who had amassed wealth by their work “brutes loaded with gold”; they were certainly not so brutal as the ironical pride of some people lead them to suppose as they were able to acquire by their own efforts those goods so envied by the very people who applied to them so cruel an epithet and, admitting the truth of the insulting expression, it must be agreed that between brute and brute, it was better to belong to

the type of gold—laden brute with privations and with an empty stomach. Already the man who has improved his material condition made use, in addition to his work, or methods which we may call collateral, to wit: tolerance, by means of which the man whose object is to make money cannot afford to provoke harmful antagonisms and seeks harmony; courtesy, the purpose of which is identical; discretion, affability, prudence, precision, neatness, and, in a word, all beneficent qualities unnecessary in a petty tyrant who, protected by his position and privileges, gains his ends and follows his way without having to win the regard of any persons other than those who command him.

Cacique benefited.—The acquisition of some property gives a man the immediate benefit of not having to devote all his time solely to making his living, he being able, therefore, to employ his leisure moments in learning or doing something for his moral and intellectual improvement. On the other hand, accumulated money permits its owner to give work to other persons, thus increasing the number of individual producers for his own private benefit and to the benefit of the community.

The obstacles placed by the laws to a change of residence; for the sole purpose of facilitating the collection of tribute, and in order not to disturb the constitution of each *barangay*, were other causes of the compression of the individual. The result of such compression was a great benefit to *cacique*, as persons forcibly kept within an administrative territory were obliged to submit unconditionally to their chiefs, whose persecution they could not avoid by immigrating, so that the only recourse they had for defending themselves was to resign themselves to the rule of a class with usurping tendencies, or succeed in getting property in order to range themselves with the dominant group.

As the excessive rigidity of that system of sequestration in the end was troublesome to the very parties concerned in maintaining it, they at last themselves requested some modifications which appeared to them likely to secure them greater benefits.

The British.—The taking of Manila in 1762 by the English had subsequently great influence on our future. They, during the occupation of Manila, had an opportunity to learn the natural resources of this country, the condition of abandonment and neglect of agriculture and commerce, and the contempt that was felt, for them, and realize the possibilities that existed for material development as understood by the British. As a result of such contact with the Filipinos English commerce

was able to understand the conditions of our Archipelago until then entirely unknown, owing to the conditions their tutelar sequestration, and on their part the authorities and prominent persons of Manila had occasion to observe, during the short period of the occupation of Manila, what the English were who had been reputed as the enemies par excellence of the Roman Catholic Apostolic religion. It is said that they appropriated to themselves the money that they found in the Treasury, which, on the other hand we must assume was found empty, both because Anda y Salazar took with him what he could find there to organize the war, and because private persons concealed their treasure. From whatever source it may have come, either brought by them as was really the case, or taken from the Filipinos, the fact was that in order to maintain themselves, they spent a great deal of money and placed in movement the dormant activity of all whom they found within their reach.

Direct Communication.—In 1771 an experiment was made in Manila by sending to the Malabar coast the frigate *Deseada*, but the trial was not subsequently repeated, Asiatic vessels continuing to carry on the trade between ourselves and Asia. Some years before King Charles III ordered the establishment of direct communication between Cadiz and Manila, a frigate of war being sent annually with a European cargo and returning loaded with the products of China and of the Philippines. As a result the frigate *Buen Consejo* made the first trip in 1765 and the service was kept up until 1783 when it was abolished.

In 1785 the King at last authorized the creation of another association similar to the one which we have seen failed in 1733, entitled *Real Compañía de Filipinas* to which was given the monopoly of the navigation and the commerce between Manila and Cadiz and the ports of Asia. This company could take no part in the Acapulco trade and to it all the old barriers were thrown down, permitting Manila trade to ship all sorts of products of Asia and the Philippines. The company, in order to create a trade in native products, at that time very small, distributed money amongst farmers for the cultivation of cotton, the mulberry tree, indigo, sugar cane, spices and some industrial products.

The bane of cane and nipa.—In this way a new element was introduced which was essential for economic development—capital. Up to that time money had been scarce and it was all derived from local source: owing to the conditions to which

we have heretofore referred our community was obliged to furnish its own capital. It was necessarily small, first on account of the slight productive forces, second because of the easy destruction of acquired property, which was dissipated in fires and storms principally. In those first days of our history, the preservation and transmission from one generation to another of created and inherited wealth was, as it is even now, a problem almost impossible of solution. The general construction of houses, manufactured from such weak and transient elements as cane and nipa, does not leave us in a condition to conserve: it leaves us rather in a condition of easy destruction, as may be readily understood. So it is that we get the benefit of only a very small part of the property acquired by the generations that have gone before us. Where will you find even the trace of so many millions of cane and nipa houses which have absorbed the money earned by the past generations? Destroyed by fire and storms. In their destruction was also involved all the industrial production, all the labor converted into capital represented by furniture, books, manuscripts, cloths, jewelry, coins, articles of practical utility, religious, artistic and every other sort of objects which ran the same precarious risk and had the same ephemeral existence as our flimsy cane and nipa houses. See, gentlemen, how many unfavorable elements, how little of construction in our economic work against so much destruction. Natural and artificial causes of compression and destruction were greater than natural and artificial causes of expansion and conservation.

Amigos del país.—Basco y Vargas, who took over the Government of the Philippines in 1780, was the only governor who understood the need of fostering the material development of the country, devoting to this purpose his energies and incurring the dislike therefore of all the directive element of the colony. In 1781 he founded the *Sociedad Económica de Filipinas* which on its subsequent revival added to its title the name of "Amigos del País," inaugurated some months before the arrival in Manila of a Royal Order of Charles III in which he recommended to the Governor precisely the organization of a society like the one he had just organized, the purpose of which would be, as the Royal Order said: "To form a society of select persons capable of producing useful thoughts."

The Governor must have been hard pushed to find that sort of persons desired by the sovereign. The fact is that if the society was able to be formed, it terminated at the same time

that the Governor left the command of the Islands. The exploiters wanted no change: "Better an evil that is known," they said, "than good to be known," and influenced by their lack of confidence in material progress, which was contrary to their theories, their practices and their necessities, they were not "capable of producing useful thoughts" for the people.

Old order reversed.—Another superior spirit was isolated and persecuted in Manila on account of his new ideas and his troublesome activity, to those who lived in the midst of the greatest passivity. Such was Archbishop Basilio Sancho who, in an eloquent alocution addressed to the *Sociedad Económica* referred to, spoke the following words which could not by any means be agreeable or even understood by his contemporaries who were at the same time his most terrible enemies: "In any other times even during the most celebrated days of Charles V and Philip II, although as regards manufactures there was great activity in many cities of Spain, whatever the cause, there was more attention given to political than to economic legislation. To-day, without omitting the former, special attention is given to the latter. A civilized kingdom in proper order needs only to instruct itself in economy and devote itself to it. This is the source from which it must take whatever is necessary for its sustenance and to acquire strength." After saying the *Sociedad* gave an impulse to economic life, he adds: "In short, if industry and plenty, if the mechanical arts and commerce placed in good order by intelligence and good taste, constitute, as they do, the happiness of a State, that is the condition in which Charles III has placed the government of his kingdom."

Basco and Archbishop Basilio were the precursors of a period near at hand; they were like the symptoms of an age that is coming, and by their ideas pointed out a new orientation that the old régime did not wish to follow nor acknowledge and which was afterward imposed by forces superior to those of the persons governing the colony.

Demanded freedom.—Returning to the *Real Compañía*, in spite of the protection and prerogatives granted by the monarch, it declined from year to year. Badly managed, making absurd commercial operations, as it followed no true mercantile principle, but operated along unwidely, complicated and selfish administrative lines, the company was a complete failure, putting an end to its business in 1830, in which its rights and privileges were declared expired, leaving the port of Manila *de jure et de facto* open to foreign commerce and navigation.

If such transformation was convenient to the interests of the Filipino people, you can imagine that it was not by any means to the interests of the privileged class, for the reason that their primitive methods of acquiring wealth had come to an end. True economic life demanded *freedom of work and freedom of exchange*.

Pointed the way.—Freedom of work hurt the social class which lived off its exploitation under the protection of the powers and of the law: production escaped from their hands and the parasitical methods of the exploiters came to an end. The freedom of exchange also took commerce out of the hands of the same privileged class and placed it at the disposition of others better qualified for it: No change of more transcendental and beneficent results for the Filipino people could have been made. Commerce was to cease being a force for exploitation.

But you already know what happens with every change: it is always received with prejudice and provokes hostility, as in front of it rises the tremendous fortress of tradition and customs, and obstacle which, certainly, once overcome, will serve as a refuge to the new acquisition of our society, which will in turn be kept as a tradition and custom.

The encouragement given by the *Real Compañía* to develop industrial and agricultural production backed by the money it had distributed in the provinces with that purpose had at length to produce their results and if the Company did fail, on the other hand, thanks to it, Philippine production made considerable progress.

Economic birth.—The “brutes loaded with gold” give a proof of their intelligence and of their aspirations by sending their children to Manila to be educated, buying furniture, mirrors, articles of luxury for their homes and persons; buying pianos, carriages, objects imported from the United States and Europe which came their way, owing to the foreign trade. These articles caused a revelation which produced a revolution in the public conscience, thanks to that veritable revolution of an economic character which permitted the only possible development—material development.

The necessities of commerce, demanded not by the poor but by the powerful, were attended to; for that reason roads were made, bridges were built, new highways of communication were opened, public safety was organized in a more efficient manner, the abuses of the dominators had greater publicity and therefore were fewer and more combated, the mail service was

improved, Spaniards and other Europeans penetrated the provinces, the natives themselves were permitted to go from one pueblo to another and change their residence, and the Filipinos were able to place themselves in contact with the civilized world, emerging from their prolonged and harmful sequestration as a result of the effort of economic impulses.

March of progress.—We emerge from that period owing to purely natural causes. There is no doubt that for religious purposes, tutelar sequestration did not offer any cause of compression; on the contrary, it was the most adequate cause for religious work. However, in spite of being contrary to the artificial policy followed by the King of Spain and his representatives, that period could not sustain itself, falling naturally, because it was contrary to the nature of the laws which rule human progress: because it was contrary to economic progress. If we had not emerged therefrom we would not have progressed: the freedom of trade, in opening for us the doors of material progress, placed us in the way of our intellectual progress and in all its fulness. Admittedly, we do not here witness a novel spectacle in the life of humanity, but we see repeatedly in our country the same process by means of which, during the entire history of mankind, man has ever marched from the conquest of material welfare to the conquest of intellectual and moral progress; from the acquisition of material necessities, beginning with the most essential, which is nutrition, to those of a higher order, based one upon another, in a natural order determined by a concatenation of causes and effects which artificial means, voluntary or unconscious, placed to changed its course, have only served to paralyze or retard.

A commercial aristocracy.—Freedom of trade had to change our economic state, but the upper class, educated under the influence of the ideas of the first epoch, had neither preparation to avail itself of the novelty nor even the disposition to understand its benefits. It was made from the same mould: its economic combinations placed at the lowest level manual production, industry, agriculture, because they had been accustomed to look upon them as the activities proper to the lowest and least considered classes in society. Commerce was on a higher level, practised by the governors themselves, the *alcaldes mayores*, civil military and religious authorities, protected moreover by monopolies, privileges, and exemptions which gave it the full character of an aristocratic institution. On the top level were the ecclesiastic, military, and legal profession which

constituted the aristocratic professions. Thus was constituted a spirit appropriate to that of the period of sequestration, and it may be said that the Colonial policy of that time had gained its triumph.

Commerce, even on a small scale, is rather an intellectual occupation; it does not require much work and at times almost none: it requires calculation, foresight, honesty, or trickery according to the times and cases, it is, in short, an activity having two moral aspects diametrically opposed, according to whether it operates under oppressive laws or under free institutions. In the first case it exploits, deceives barefacedly, oppresses, uses and abuses its privileged situation; in the second case, it wins by procedure of an elevated character, such as square dealing, exactness in carrying out agreements to buy and sell good quality of products and merchandise dealt in, competition—in short, it is founded on the interest of the producer and the purchaser too, and in this manner is calculated to win the confidence and the custom of each other.

The way to liberty.—Whoever understands by economic development only that due to the production of manual labor, is in error. It is true that primitive material development had that character of manual production, but modern economic combinations embrace other forces of human activity; material forces are no longer sufficient. Now human forces are employed which comprehend the intellectual forces and owing to this combination the right of each is made clear and affirmed, the tendency is to improve wages, the discovery of what is useful end beneficial for man is encouraged; the sentiments of solidarity, altruism and coöperation, sanitation, relief to the destitute, the sick, the weak, the transformation of jails into industrial and moral school, savings and life and property insurance are born; in a word all modern civilization, essentially economic, essentially scientific and productive, has been founded.

Liberties relating to material interests are, by natural and historical order, anterior to and determinant of moral and intellectual liberties. Whoever has no right to free work, whoever has not free disposition of the product of his labor, does not understand, nor seek, nor can avail himself of, other kind of liberties. When Luther proclaimed free examination in religious matters no one suspected in Europe that the consequence of his doctrine would reach political institutions, but it was natural and inevitable that, if the Pope was discussed, the royal power should afterward be discussed, and that is exactly what happened.

A collision.—Freedom of trade was bound to bring capital and active people from the outside of the Archipelago. Capital would be of use to develop production and, naturally, consumption and exportation. Persons who came freely brought new ideas, new methods, new moral, and intellectual needs, without the support of privileges which, served for exploitation, so that such men had to influence favorably the general progress of the Filipinos.

The first result was the collision of the new arrivals with the exploiters of the old order, whose peaceful possession of a livelihood which suited them, because nobody questioned it or disturbed it, was suddenly threatened by the competition of more active, more industrious better prepared and richer individuals, supported by firms located in the most important centers of the commercial world. In the same manner as by the arrival of the Spaniards, the old Filipino *caciques* were subjected to the Spanish functionaries, now the *caciques* who dominated during the period of tutelar sequestration found themselves immediately supplanted and converted into something lower, than the new *caciques* of an economic order. They understood that such supremacy would give them supremacy in everything. To defend their position they had recourse to the anti-foreign sentiments of the entire society: foreigners had always been regarded as the enemies of Spain and of God: they must also be the enemies of the Filipinos. The crusade was not new, it had been used before with excellent results at the time of the English domination. This campaign was hardly started when the cholera for the first time made its appearance in Manila. Taking advantage of that event, which was also called providential, the rumor was started that the foreigners had poisoned the waters of the Pasig, with the results that in 1820 the people of Manila exterminated the foreigners who were then residing at the capital.

A new order.—Recommendations, favor, and relationship served in the old social order to secure occupations of an official character: every governor arrived in Manila, as is mentioned by all chronicles of the time, accompanied by a numerous following of parasites, friends, relations, godsons, pages, and favorites incapable of doing anything useful, who were later placed by their patron in *alcaldías*, *encomiendas*, offices of every kind in which each of them developed his faculties for exploitation, as best understood by him, to acquire a fortune by the means that I have already mentioned. Now, men who repre-

sented the new type of social authorities were naturally insensible to the recommendations for favor as regards the agents and employees necessary to carry on their business, whom they sought amongst persons who were really qualified by their intelligence, activity and morality.

One of the causes of the failure of the celebrated *Real Compañía de Filipinas* was precisely the incompetent force that managed the business in the Islands, selected in Spain not on account of personal qualifications but by the intrigues of favor and political recommendation. In the new commercial and economic life there were sought those men of useful thoughts recommended by King Charles III, in the *Real Compañía* managed by General Basco, and the men so furnished found positions, or freely and on their own account, established themselves in the new activity which transformed our society.

"Filibusterismo" Born.—During the previous epoch the so-called natural resources constituting the extractive industries, consisting of the collection of the spontaneous products of nature, were exploited, to the extent that the freedom of trade brought about the development of agriculture which had already been initiated by the *Real Compañía*. In Ilocos indigo was made, in Batangas, Pampanga, Bulacan, Laguna, and the Visayas sugar cane was cultivated and sugar was made; in Albay abaca was produced. Vigan, Taal, Balayan, Batangas, Albay, Nueva Caceres, Cebu, Molo, Jaro, Iloilo, began to be covered with solidly constructed buildings; their wealthy citizens would come to Manila, make purchases, become acquainted with the great merchants who entertained them in their quality as customers, whose trade they needed; they visited the Governor-General, who would receive them according to the position that their money gave them; they came to know the justices of the Supreme Court, the provincials of the religious orders; they brushed up as a result of their contact with the people of the capital and on returning to their pueblo they took in their hearts and minds with them the germ of what was subsequently called subversive ideas and later still *filibusterismo*.

Defending rights.—The opening of the Suez Canal brought us nearer to Europe, and carried along by the current of economics, came ideas and principles of a political character which could do no less than revolutionize the ideas current in a country which had existed so completely separated from the nations of the modern world. Already the brutes loaded with gold dared to discuss with their curate, complain against the *alcalde*,

defend their homes against the misconduct of the lieutenant or sergeant of the constabulary police; such people were starting to emancipate themselves insensibly as a consequence of their economic independence. Their money permitted them effectively to defend questions involving money first then those of a moral nature—they were actually becoming insolent according to the expression of the dominators: in reality they were beginning to learn to defend their rights.

Prison and scaffold.—A question of economic character provoked the clamorous protest from the people of Calamba in which the Rizal family came to be involved and which decided our Martyr to write his two famous novels and then play so decisive a part in the history of the Filipino people; an economic question provoked against the Friars the most vehement hostility with respect to their estates, an economic question, that regarding the tobacco monopoly, exercised, under a rule of oppression and abuses, the inhabitants of Cagayan and their neighbors of Isabela; another economic question gave the preference to Chinese over the natives in certain religious festivities in the curacy of Binondo from which there afterward resulted a series of deportation and imprisonments of Filipinos who, due to transformation wrought in the minds of the governing class, from the category of brutes loaded with gold passed to that of discontented, suspicious Free Masons, or anti-Spanish, filibusters, and finally, to traitors, with which last epithet the scaffold or at least prison and deportation were most surely attained.

You will now understand the type of Filipinos, who in the time of the old sovereignty, died as traitors, according to those who governed us, or as patriots, according to ourselves, the governed. It was not the education of the schools which transformed our enlightened class, as, if it is certain that the moral principles of their education in our centers of learning were good and useful, on the other hand the political and social ideas which they received tended to form and maintain resigned subjects who had submitted to a foreign sovereignty and were managed passively by the ecclesiastical institutions. They were right in having no faith in the monied Filipinos; they were the first of the discontented. The poor had to be resigned and submissive until, carried along by the others, they in turn understood that submission and resignation are obstacles to progress.

The heaven of liberty.—I think it important to clear up a thought which might be misunderstood. When I said that the monied men were the ones who could reach intellectual and moral improvement I did not mean to say that it was necessary to be rich in order to do so but to have certain degree of material welfare. Nor do I mean that now the poor cannot attain such improvement, that they are incapable of having the qualities which I have given the first group. I do mean to say that useful progress, today within reach of the poor as of all individuals of humanity, was first conquered by those who enjoyed that material ease to which I have referred. Carriages, tramways, the telephone, the telegraph, artificial light, glassware, porcelain, cloth are all today within the reach of everyone: in the beginning, after their invention they were used only by the wealthy on account of their excessive initial cost. Ideas have followed an equal development. Self-respect mistreated, vanity wounded, natural pride offended, first impelled the wealthy to personal protest of an egoistic character, then to protests and claims of a general character, for himself and those of his race, for all his countrymen. As he was discontented and had economic independence, his education did not serve to make him resigned, but to make him understand the justice of his aspirations for liberty, and to save him from oppression.

National upbuilding.—The education we were given was not certainly sterile; it has served us to form an enlightened class loving order, respecting and seeking legality, aspiring to orderly, peaceable, honorable, worthy, and industrious progress. For that reason our revolution stopped when we got the Government which gives us freedom to work, under law and order, for the realization of our ambition to constitute a free country.

For these motives, with the immolation of Rizal, at the same time that nothing could hold back our revolution, nothing was able to impede our giving a start to the period of National Upbuilding.

A western mentality.—This period begins naturally with the organization of the Philippine Republic at Malolos in 1889. Let us allow some person to regard our ephemeral republic with a pitying smile. Neither contempt nor scoffing nor applause changes the essence of things, and that even is and will always be the first of the history of the construction of Philippine nationality.

But a few days ago I had the opportunity of giving a lecture on the New Philippine Mentality. I have affirmed that we

posses a western mentality, and I have also said that we hold to same erroneous ideas learned in the first years of our education, amongst others, that of considering as secondary material development, that of believing that the wealthy have little influence on our moral and intellectual progress, an idea connected with that which originated the phrase of "brute loaded with gold." Both traditional ideas must disappear as absurd and contrary to our general interests.

American standards.—We know that we must look for independence to the United States, and that the Americans will be the ones to judge our capacity to maintain a government of our own. Now, it appears idle to add that they will judge us according to their standards and not according to ours. We must therefore know what the conditions are which they seek in us in order to declare us capable, and at once we find that economic capacity is, according to their views, the decisive one. It would be enough probably for us to know this fact, for us to devote our energies to the development of our economic conditions; but, proceeding logically, and so as not to lend ourselves to following a route which may turn contrary to any other interest of our nationality, in order not to work in the dark as submissive believers of past times, obedient to advice, the scope which we do not know, and the consequences of which we can get no glimpse, we must study the matter, in order subsequently to take the decision that reason and advisability may dictate.

Money essential.—To begin with, as elements of judgment, we have in this problem those derived from our own history which I have had the pleasure of mentioning up to this instants. We also now see that the problems of material welfare is the one which most urgently calls for solution at all times: Hunger, as the result of droughts, storms, too much water from floods; periodic disasters occasioned by fires in nipa and cane towns, there being no money for more solid constructions; paralyzation of agricultural on account of rinderpest; lack of money, and, as a result, increase of usurious loans and, as is natural, impossibility of attending to highways of communication, the construction of schools, to sanitary requirements and other important needs of a modern society.

Japan and France.—Wherever we fix our gaze in the whole world we see the economic question considered as the first factor. Japan belonged to the military and religious type of civilization where the directive class, composed of warriors and priests,

looked down upon those who lived off agriculture, industry, and commerce, which were the activities of the domain of the plebeians. By its military power Japan is now placed among the first-class powers; however, its aggressive force is compressed and limited by its economic debility. On the other hand, the United States, whose military force rests upon its navy, was not long ago in a condition of relative weakness, but as a result of its economic power, nothing was easier to it than to create for itself a formidable navy which will be increased as much as its desires, as its economic power permits it to do so.

France did not disappear from the map of Europe as a nation after its defeat by Prussia, because of its wealth; its military power at the time proclaimed to the whole orb, as an illusion, as the war showed; its economic power came as a revelation, when it was able to save its national personality, which was thought to have been lost by its military disaster.

Germany.—The German Empire is considered the foremost military nation today; but before it was military it was, as it still, is highly industrial, and thanks to its scientific civilization it obtained its warlike supremacy. Its military force was created to defend and increase its economic life. Its soldiers and sailors are for the protection of the nation and of its interests in Europe, as well as for the protection of the commercial expansion in the world whose markets are invaded by the products of its industry, marked in the language of commerce par excellence, "Made in Germany." With great reason Herbert Spencer says:

The source of progress.—"What makes the relations of cause and effect existing between the industrial order and free institutions more comprehensible is the fact that the countries where the greatest changes have been brought about in the sense of political liberty, have been industrial countries. Wherever industrial activity and structure are developed, the right of free private examination in religious matters is established little by little at the same time as political rights are established."

Economic development is based on the development of manual labor and intellectual labor of a productive character. All sociologists and moralists are agreed in recognizing work as the source of progress and, therefore, as the first duty of man. This being true, what surprise is it that economic progress is

of fundamental importance in modern civilization it being the immediate and natural result of work?

"Perpetual inferiority."—The Italian professor Messo says: "Economic conditions are the generating power of all progress." He affirms that the struggles of the future will take place in the industrial and mercantile arena, and that the less educated nations will be fatally subservient to the superior peoples, and will see themselves condemned to the most humble and least remunerative industrial labors; in short, that the people of the most inventive genius will get first place.

In olden times, kings and warriors conducted conquests and in their interests subjugated people; today nations, the people themselves, are interested in conquests, or at least in contact with other people, guided by the modern inducement, by the factor of our age, to wit, economic needs.

The enormous production of machine manufacturing and of applied chemistry push nations of productive activity on in the search for new markets for their articles, and wars of expansion and conquest no longer depend on the ambition of a sovereign but on the necessity felt by the people, the crowds, to convert the whole world into the theater of their industrial and commercial activity.

Not to know these conditions is to be condemned to perpetual inferiority and permanent tutelage.

Productive work.—But, what in the end is military power but the triumph of industrialism, of the use of machinery, of chemistry, of scientific and reproductive civilization? Without industry applied to the instruments of offense and defense, which are the implements of war, where would be the military and political power of modern nations? It is impossible to conceive military and political power without the existence of the material for war created by material or intellectual forces of man in his work of production.

We call *clase ilustrada* in the Philippines what in other countries is called the middle class; our enlightened class is composed principally of men of an economic condition at least easy, not of doctors, lawyers, professional men, theologians, and literary persons. We have already shown how this middle class was formed, how it was redeemed, created and fortified by economic phenomena. Now, let us not be deluded by the illusions of a sentimental and literary education, but let us

always have in mind our formation of economic origin, based on productive work, and if up to the present, we have allowed ourselves to be led by unconscious and natural forces, henceforth, knowing these phenomena, let us try rather to contribute to their development by placing in the same direction the voluntary action of our energy. (PHILIPPINES FREE PRESS, March 29, April 5, April 12, April 19, April 26, 1913, under the caption title of. "*The Economic History of the Philippines.*"

BY THE GOVERNOR-GENERAL OF THE PHILIPPINE
ISLANDS—A PROCLAMATION

No. 18

WHEREAS, man is dependent upon forest trees and cultivated plants, the insect enemies of which are kept in check by wild birds;

WHEREAS, thousands of insect-eating birds are thoughtlessly killed each year with benefit to no one;

WHEREAS, the protection of trees and birds can only be assured by widespread appreciation of their beauty and value;

Now, therefore, I, Leonard Wood, Governor-General of the Philippine Islands, do hereby proclaim the second Friday of October of this year and of all succeeding years, Bird and Arbor Day, to be observed by appropriate exercises in schools and elsewhere, by the planting of trees and by the study of birds.

Done in the City of Manila, this seventh day of April in the year of our Lord, one thousand nine hundred and twenty-five.

(Sgd.) LEONARD WOOD
Governor-General

NOTES—SECOND QUARTER

Dr. T. H. PARDO DE TAVERA

The Government of the Philippine Islands and the country itself has recently suffered another loss. Dr. Trinidad H. Pardo de Tavera, Director of the Philippine Library and Museum, died March 26, 1925. Considered the greatest Filipino scholar and leader of thought of his time, this virile and versatile writer dedicated his pen, in particular to the social and economic problems of his country.

Born 68 years ago in Manila, he received his early education in the University of Santo Tomas, graduating in 1886 with the degree of doctor of letters and philosophy and doctor of medicine. In 1887 he was appointed delegate from the Philippines to the Indo-Chinese Academic Society of Paris. He was granted also the degree of doctor of laws in 1913 by the University of the Philippines. At the time of his death he was a member of several scientific societies here and abroad.

During the Revolution against Spain and the war against America, he was made Director of Diplomacy in General Emilio Aguinaldo's cabinet. On the restoration of peace, and on the establishment of American rule, he was one of the first to coöperate with the new Government; and together with Felipe Buencamino, Sr., he founded the Federal Party, the main plank of its platform being the annexation of the Philippine Islands and the granting to the Filipinos by the United States of all the constitutional rights, privileges and immunities of American citizens. As an organ of this party, he founded "La Democracia," an evening daily. Later he was appointed a member of the Philippine Commission, in which capacity he was the author of many constructive laws. He headed the first Filipino Mission sent to the United States during the early days of American occupation.

Some time afterward he resigned from the Philippine Commission, and devoted his time to writing and lecturing on social and economic problems and in traveling abroad. Two years ago he was appointed to the position he was holding when he died.

Doctor Tavera was a staunch supporter of English as the official language and of the policy of giving prime consideration to the solution of our economic problems so as to make this country truly independent. He had a great moral courage and was uncompromising in his convictions, which is one way of saying that he lacked not opponents, but as time passes and present prejudices cease to count, his work will be more and more estimated at its rightful value and his proper place in history be more fully assured.

THE NEW DIRECTOR OF THE BUREAU OF NON-CHRISTIAN TRIBES

One of the recent appointment made by Governor-General Leonard Wood was that of Mr. Ludovico Hidrosollo as Director of the Bureau of Non-Christian Tribes. Mr. Hidrosollo belongs to that group of successful men who were sent to America in their youth as Government students. He graduated from the Michigan State Agricultural College with the degree of bachelor of science in agriculture in 1908. On his return, in the same year, he was appointed assistant in agriculture in the Bureau of Agriculture and from this modest position he rose step by step until he was appointed to his present important position of Director of the Bureau of Non-Christian Tribes. He has behind him a remarkably varied record in the Government service as will be seen in the following list of positions he has filled therein: assistant in agriculture, Bureau of Agriculture (1908); teacher and acting supervising teacher, Bureau of Education (1909); agricultural assistant (1912); fiber inspector (1915) and assistant chief, Rural Credit Division (1916), Bureau of Agriculture; agricultural inspector (1917) and technical assistant (1918), Bureau of Non-Christian Tribes; supervising agricultural agent (1918) and acting chief, Demonstration and Extension Division (1921), Bureau of Agriculture; and special agent (1923), Bureau of Non-Christian Tribes.

From the above it may be noted that Mr. Hidrosollo spent several years in the Bureau of Agriculture. He is the fourth man from this Bureau appointed chief of another Bureau or Department of the Government, the others being Dr. E. D. Merrill, former Director of the Bureau of Science; Mr. Jose G. Sanvictores, former Director of the Bureau of Non-Christian Tribes and the Honorable Silverio Apostol, Acting Secretary of Agriculture and Natural Resources.

THE ILAGAN TOBACCO STATION

By DOMINGO B. PAGUIRIGAN

The Bureau of Agriculture has recently transferred its tobacco station in the Cagayan Valley from Dammao, Gamu, to Ilagan, Isabela, the capital of the province, which town may also be considered as the center of the tobacco region proper, inasmuch as this region extends only from Jones, Isabela to the boundary between Gattaran and Alcala, Cagayan.

The Ilagan Tobacco Station is most favorably located for the further reason that Ilagan is also a trade center and the new site includes a high piece of ground at the southern extremity of the town on either side of what will be the last link of the great Cagayan Valley Road connecting Ilagan direct with Manila when constructed; and authoritative information leads to the belief that sometime during the first half of this year, this great road will be finished.

Another favorable circumstance is that the station is at the entrance of the great basin of the Pinacanauan de Ilagan River, wherein are located three of the five largest tobacco haciendas in the Cagayan Valley.

The Ilagan Tobacco Station has two experimental plots A and B. Lot A in the barrio of Cammunatan, a little less than a kilometer south, is largely clay loam, or uniform physical composition, level and therefore, suitable for experimental purposes. It covers an area of about 70 hectares and represents that one common type of tobacco soil in the Cagayan Valley which is seldom inundated (ugac). Lot B is in the barrio of Guinatan, about a kilometer north. It is also level and the land there is of the other type (more common at present) of tobacco soil, which is alluvial (murung) due to yearly inundations and therefore perpetually fertile. It comprises about four hectares only but that is sufficient for experimental purposes.

With these advantages the Ilagan Tobacco Station will soon be in a position to gather and compile abundant data on the problems of tobacco growing and curing in the Cagayan Valley.

Briefly, the activities of the Ilagan Tobacco Station includes the following:

1. By proper breeding and cultural methods to develop filler strains of the highest yield, disease resistant, early maturing and of good smoking qualities as a whole; and to acclimatize or develop wrapper strains from exotic and native varieties adaptable to the soil and climatic conditions of the Valley.

2. To make studies of the most common local insect pests and diseases of tobacco with a view to finding the most effective and economical means of controlling them.

3. To make further studies on curing, fermentation and proper methods of preparing the leaf tobacco product for the market.

4. To maintain yearly (during the tobacco season) cultures for demonstration.

5. To maintain a permanent exhibit of the tobacco industry to be open to visitors throughout the year, for demonstration purposes.

6. To present in the newspapers and the Bureau publications, data on all the experiments tried for the information of everybody concerned; and to present timely hints in the local vernacular weeklies as an effective way of reaching the tobacco farmers.

7. To undertake field investigations throughout the valley, primarily for the purpose of solving local problems.

8. To answer immediately all inquiries from any source relative to the Philippine tobacco industry as a whole.

9. To hasten the production of more selected seed from the best strains with a view to gradually eliminating the "mongrel" stock.

10. To hold a yearly tobacco growers' conference and exhibition in cooperation with the Extension Division and others concerned as in important method in educating the tobacco farmers.

11. To cooperate with the Bureau of Education through its local farm schools in order to influence the farmers through the school children to adopt better cultural methods.

12. To cooperate with the Bureau of Commerce and Industry and Internal Revenue and the local officials in the organization of Coöperative Marketing Associations; in the proper interpretation of the Tobacco Law (Act No. 2613) as amended; and the improvement of the tobacco industry as a whole in the Cagayan Valley.

The Ilagan Tobacco Station has already classified the different tobacco varieties heretofore found only in "mongrel" combinations, in the Cagayan Valley. The relative study of the different individual merits of these varieties, after they had been separately isolated, revealed the fact that while some are of good, others are of very undesirable "blood." The bad lot should be eliminated through the use of pedigreed seed from healthy mother plants. Selection for seed, however, is such a long story that those interested had better refer to the latest tobacco circular of the Bureau of Agriculture.

In the experimental fields of the station, practical demonstrations on tobacco culture will be made every season as follows:

AUGUST, SEPTEMBER, OCTOBER, AND NOVEMBER

Preparation of a series of three seed beds at intervals of 20 days.

Sterilization by boiling hot water and formalin solution to control usual or characteristic diseases of seed beds.

Protection of borders of beds to avoid wash-outs.

Erection of portable cogon covers of beds to prevent destructive effects of very strong heat and wind.

Sparse sowing to produce vigorous seedlings.

Spraying with Bordeaux mixture to control other fungous diseases.

Application of Paris green with corn meal to control insect pests.

Preliminary breaking of field with Luzon Lagio plows.

NOVEMBER, DECEMBER, AND JANUARY

Final preparation of ground.

Disk harrowing and its efficiency.

Laying the furrows for transplanting.

Plants set out 80 centimeters apart in rows 80 to 100 centimeters apart depending on the size of the filler varieties to be planted.

Plants set out 50 centimeters apart in rows 80 to 90 centimeters apart depending on the size of the wrapper varieties to be raised.

Wrappers varieties may also be set out 50 centimeters apart in alternate rows—60 and 80 centimeters apart (Sumatra method).

Cultivation with native plow of early crop.

Mulching with surrounding soil by hand.

FEBRUARY AND MARCH

General cultivation—two to four times depending on rainfall.

Application of insecticides in early stages of development of the plants.

Hand-picking of insects in later stages of development.

Suckering practised generally.

Early topping of all weak individuals. General topping of all plants except those intended for seed (just before blooming of flowers).

First picking (harvest) of early crop by priming as applied to all cigar tobacco types or varieties.

APRIL, MAY, AND JUNE

The height of the harvesting season.

Priming at least four times practically harvesting all the leaves from a plant at intervals of from 5 to 7 days.

Harvesting only after 10 o'clock in the morning during clear weather to avoid dew or rain-drops on leaves.

Sticking by modified native method (one finger space apart) of all wrapper leaves; sticking by wholly native method of all filler leaves.

Curing of wrapper leaves wholly in the shade and one or two days of preliminary sun curing of all filler leaves depending on texture.

Removal of leaves from racks only when the mid-ribs are also very dry.

JULY AND AUGUST

Fermentation process in progress.

Classification according to Bureau of Internal Revenue regulations.

Preparation of old style hand (manos). This is the only practical way as it protects leaves from rough handling and the cigarette beetle.

The curing process is carried on in the model tobacco curing shed in experimental lot A and the fermentation process in the warehouse on the grounds.

The station is supplied with valuable text books, bulletins and periodicals on tobacco culture. These books and pamphlets are also available to all interested. The station is going to collect whatever it can in the way of an agricultural museum. It already has a collection of preserved insect pests of tobacco and one of preserved characteristic leaves of different varieties of cigar tobacco, tobacco leaves attacked by different fungous diseases, and tobacco leaves showing the influence of the seasons on the size and quality of the tobacco crop.

In the station laboratory is stored and catalogued pedigreed tobacco seed in hermetically sealed vials and "mass" or general seed, in carefully wax-sealed demijhons. There are a few pieces of apparatus and a supply of the necessary chemicals. Here, during the tobacco season, insect breeding is done and cultures of diseases made as part of the efforts of the personnel to study out effective and economical means of control of the most important tobacco insect pests and diseases.

The Ilagan Tobacco Station was appropriately inaugurated by calling a conference of tobacco growers, who foregathered from over the Cagayan Valley, December 29, 1924, a proof of the desire of the growers to actually get down to the business of solving their common problems.

The station is in charge of the writer who supervises all tobacco investigations for the Bureau, and two assistants Messrs. Hilario T. Maggay and Ulpiano V. Madamba. All of these men are natives of the Cagayan Valley and are graduates of the University of the Philippines in agriculture.

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